MARKET ORIENTATION, ALLIANCE ORIENTATION, AND BUSINESS PERFORMANCE IN THE CANADIAN BIOTECHNOLOGY INDUSTRY

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By

Grant Alexander Wilson

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Abstract

There is a large body of research supporting the importance of market orientation in determining performance. A growing body of research supports the notion that strategic alliance management competencies positively influence performance. Few empirical investigations have examined the importance of market orientation in the biotechnology industry, much less the effect of alliance orientation on performance, or the combined effect of market and alliance orientation on performance. This study explores these relationships among Canadian biotechnology companies with medical/healthcare focuses. Of the 394 Canadian medical/healthcare biotechnology companies identified, 81 usable responses were received, yielding a response rate of 20.6 percent.

It was found that market orientation positively and significantly influenced business performance, supporting the first hypothesis. Additionally, alliance orientation positively and significantly influenced business performance, supporting the second hypothesis. However, when market and alliance orientation were examined together, alliance orientation's effect on business performance remained positive and significant, but market orientation's effect on business performance became negative and non-significant. This prompted a further analysis that investigated the presence of a mediation relationship. Market orientation was fully mediated by alliance orientation in its relationship with business performance.

This study contributes academically by adding to market and alliance orientation research and by the successful development of a biotechnology-specific performance instrument. This study contributes to marketing and management strategy, as it outlines performance indicators that enable high performance.

Dedication

This Thesis is dedicated to my parents. To my father, a leader, entrepreneur, visionary, mentor, and friend. To my mother, a nurturer, supporter, questioner, and friend. Your love, encouragement, support, and positivity will forever be cherished and emulated.

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CHAPTER 1
INTRODUCTION

Biotechnology is "the application of science and technology to living organisms, as well as parts, products, and models thereof, to alter living or nonliving materials for the production of knowledge, goods, and services" (Organisation for Economic Co-operation and Development 2011). The North American Industry Classification System (2007) provides a similar definition of the biotechnology industry, emphasizing the industry's use of research and development (R&D) in the areas of microorganisms and genetic alteration to discover new processes, prototypes, and products for various sectors (North American Industry Classification System 2007). In its entirety, the biotechnology industry "consists of the development, manufacturing, and marketing of products based on advanced biotechnology research" (Datamonitor 2011d). Due to the increase of cross-border financing, technology, alliances, and mergers and acquisitions, biotechnology is a rapidly expanding worldwide industry (Datamonitor 2011d; Simon and Kotler 2003).

1.1 Biotechnology Market

In 2010 the global biotechnology market value was estimated to be 250 billion USD and projected to grow to 300 billion USD by 2015 (Datamonitor 2011d). The largest subsector of the global biotechnology market is medical/healthcare, accounting for more than 67 percent of total market value (Datamonitor 2011d). The biotechnology industry in the Americas (North and South America) accounts for over 46 percent of the global market (Datamonitor 2011d). Specifically, the United States (US) is the world-leader in biotechnology (Datamonitor 2011a). Similar to the US, Canada is a leader in biotechnology, ranking in the top five countries globally (Conference Board of Canada 2005; Government of Canada 2011; Industry Canada 2011b). In 2010 and in the midst of global economic turmoil, the Canadian biotechnology industry

experienced an increase in the signing of licensing agreements, attainment of capital raised privately and through equity markets, and engagement in mega-mergers and acquisitions, demonstrating the industry's resilience (Ernst & Young 2011). Today, it is estimated that Canada has over 500 private biotechnology companies with at least one product in development (Conference Board of Canada 2005; Industry Canada 2011b; BIOTECanada 2011a). There are many subsectors in the biotechnology industry including medical/healthcare, agriculture/food, environmental/industrial, and information technology services (Industry Canada 2011b; Datamonitor 2011b). As with the global biotechnology market, the medical/healthcare subsector dominates the Canadian industry (Industry Canada 2011b; Datamonitor 2011b). Estimates suggest anywhere from 60 to 66 percent of all Canadian biotechnology companies are medical/healthcare firms (Datamonitor 2011d; Conference Board of Canada 2005; Industry Canada 2011b). Additionally, the majority of these companies are small- to medium-sized enterprises (SMEs) (Conference Board of Canada 2005; Datamonitor 2011b; Rajamaki 2008).

1.2 Biotechnology Managerial Skills

Renko, Carsrud, Brannback, and Jalkanen (2005) state that some managers of technology-focused SMEs tend to overemphasize the importance of science and technology and neglect managerial issues including marketing and product positioning in the marketplace (Renko et al. 2005). In the biotechnology market, effectiveness is predicated on having a strong and complete management team with competencies in all functional areas including marketing (Woiceshyn 1993). Costa, Fontes, and Heitor (2004) state that marketing is an imperative managerial competency for successful biotechnology commercialization. Additionally, biotechnology ventures with high market knowledge are more likely to be acquisition candidates, obtain licensing deals, and accumulate capital infusions (Renko, Carsrud, and Brannback 2008). Contrarily, managerial deficiencies such as the lack of marketing expertise can lead to obstacles

in the biotechnology development process (Rajamaki 2008; Costa, Fontes, and Heitor 2004; Eriksson and Rajamaki 2010). Chief Executive Officers (CEOs) and managers of biotechnology companies identified having a focus in marketing strategy and the establishment of strategic alliances as critical industry success factors (Hourd and Williams 2008). Yim and Weston (2007) found that there is a strong demand for biotechnology managers and entrepreneurs with marketing and alliance-building competencies, as these traits enable organizational success. Due to the industry's competitive intensity with regard to the attainment of capital and survival, biotechnology managers need to be successful in identifying target markets and sharing knowledge with strategic alliance partners as these competencies have been proven to perpetuate organizational success (Terziovski and Morgan 2006).

1.2.1 Market Orientation

Marketing is defined as "the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large" (American Marketing Association 2007). In marketing and management academic research, market orientation (MO) is fundamental to the marketing concept (Appiah-Adu 1998; Appiah-Adu and Ranchhod 1998; Drucker 1954; Farrell and Oczkowski 1997; Greenley 1995; Han, Kim, and Srivastava 1998; Harris 2001; Kohli and Jaworski 1990; McCarty 1960; Narver and Slater 1990; Subramanian and Gopalakrishna 2001). Conceptualizations provided by Narver and Slater (1990) and Kohli and Jaworski (1990) are the two most widely employed measures for investigating MO. Narver and Slater (1990) theorize that MO is a construct comprised of behavioural components including customer orientation, competitor orientation, and interfunctional coordination (Narver and Slater 1990; Farrell 2002). Kohli and Jaworski (1990) postulate that MO is an organizational activity aimed at generating market knowledge, disseminating knowledge throughout the organization, and incorporating

knowledge in order to better serve customers. Regardless of the measure used to assess MO, scoring high on either scale signifies organizational commitment to marketing strategy. For the purpose of this study, the Narver and Slater (1990) definition of MO will be adopted.

Utilizing the Hourd and Williams (2008) and Yim and Weston (2007) findings as a basis for further investigation, a MO instrument could be used to measure the employment of marketing strategy in biotechnology companies. Although strategic marketing capabilities are said to be an imperative in the commercialization process, the body of research surrounding marketing and biotechnology is limited, especially regarding MO in the biotechnology industry.

1.2.2 Alliance Orientation

Strategic alliances are inter-organizational agreements aimed at collectively achieving individual organizational goals and gaining competitive advantages (Elmuti, Abebe, and Nicolosi 2005; Parkhe 1993; Varadarajan and Cunningham 1995). In the pharmaceutical and biotechnology industries, strategic alliances are highly prevalent as these cooperative efforts enable global expansion and minimize risk for alliance partners (Simon and Kotler 2003; McCutchen and Swamidass 2004). Alliance orientation (AO) is an instrument used to measure the employment of alliance strategies in organizations (Kandermir, Yaprak, and Cavusgil 2006). However, unlike previous strategic alliance measurements, AO aims to comprehensively measure strategic alliance practices. Kandermir, Yaprak, and Cavusgil (2006) developed the AO instrument to measure a company's ability to scan for new alliance partners, coordinate alliance strategies, and learn from alliance experiences. Similar to MO, scoring high on the AO scale indicates organizational commitment to activities pertaining to alliance strategy. Despite the importance of strategic alliances and the AO instrument's ability to measure strategic alliance management comprehensively, no known study has employed the AO instrument in the biotechnology industry.

1.3 Marketing, Strategic Alliances, and Performance

As discussed, marketing and strategic alliances in the field of biotechnology are critical industry success factors (Hourd and Williams 2008; Yim and Weston 2007). With the use of MO instruments, Appiah-Adu and Ranchhod (1998), De Luca, Verona, and Vicari (2010), and Renko, Carsrud, and Brannback (2009), investigated the relationship between biotechnology companies' commitment to marketing and its influence on performance. Additional studies have examined the relationship between strategic alliance metrics (e.g. size, efficiency, horizontal, vertical, proactiveness) (Baum, Calabrese, and Silverman 2000; Baum and Silverman 2004; Forest and Martin 1992; George et al. 2001; George, Zahra, and Wood 2002; Levitte and Bagchi-Sen 2010; Silverman and Baum 2002; Stuart, Ozdemir, and Ding 2007). However, none have employed the AO instrument to holistically measure the relationship between strategic alliances and performance.

To date, no known study explores MO, AO, and performance in the Canadian biotechnology industry. Exploring the relationship between MO, AO, and performance in the Canadian biotechnology industry is valuable for many reasons. Namely, Canada is a global leader in biotechnology, investigating antecedents to performance has theoretical and managerial implications, MO, AO, and performance in the Canadian biotechnology context is an unstudied area, and MO and AO are measures that assess two key critical industry success factors (e.g. marketing and strategic alliances).

CHAPTER 2
LITERATURE REVIEW

Business performance is a recurrent theme for management researchers and practitioners (Venkatraman and Ramanujam 1986). Investigating possible antecedents (e.g. MO and AO) to business performance bridges the gap between management theory and practice, as results often prove to have practical implications for managers to improve performance.

2.1 Market Orientation and Performance

The MO and performance relationship has been studied across various industries (biotechnology, construction/surveyor, exporters, forestry, hotel, internet advertisers, manufacturing, mass-merchandisers, multi-industry, and services), in many countries (Australia, Canada, China, Ghana, India, Israel, Saudi Arabia, United Kingdom, and United States), with differing MO instruments, and using contrasting performance measurements (Appiah-Adu 1998; Appiah-Adu and Ranchhod 1998; Greenley 1995; Harris 2001; Narver and Slater 1990; Subramanian and Gopalakrishna 2001; Cadogan, Cui, and Li 2003; Cadogan, Diamantopoulos, and Siguaw 2002; Dawes 2000; Deng and Dart 1994; Diamantopoulos and Hart 1993; Jaworski and Kohli 1993; Kara, Spillan, and DeShields 2005; Matsuno and Mentzer 2000; Noble, Sinha, and Kumar 2002; Perry and Shao 2002; Pulendran, Speed, and Widing 2000; Rose and Shoham 2002; Sargeant and Mohamad 1999; Slater and Narver 1994; Tay and Morgan 2002; Bhuian 1998). Despite the diverse settings, MO has been repeatedly shown to have a positive, and direct or moderating role in its relationship with performance (Appiah-Adu 1998; Appiah-Adu and Ranchhod 1998; Greenley 1995; Harris 2001; Narver and Slater 1990; Subramanian and Gopalakrishna 2001; Cadogan, Cui, and Li 2003; Cadogan, Diamantopoulos, and Siguaw 2002; Dawes 2000; Deng and Dart 1994; Jaworski and Kohli 1993; Kara, Spillan, and DeShields 2005; Matsuno and Mentzer 2000; Noble, Sinha, and Kumar 2002; Perry and Shao 2002; Pulendran,

Speed, and Widing 2000; Rose and Shoham 2002; Slater and Narver 1994; Tay and Morgan 2002; Bhuian 1998). Few studies, including a United Kingdom (UK) multi-industry and a UK hotel study, showed that MO had no effect, or a very weak effect, on performance (Diamantopoulos and Hart 1993; Sargeant and Mohamad 1999). The majority of studies used data from the manufacturing industry or a multitude of sectors (De Luca, Verona, and Vicari 2010; Heslop and Qu 2007), while only a small number of studies have explored MO and performance in the biotechnology industry (Appiah-Adu and Ranchhod 1998; De Luca, Verona, and Vicari 2010; Renko, Carsrud, and Brannback 2009).

Appiah-Adu and Ranchhod (1998) employed the Narver and Slater (1990) instrument to measure MO and performance among UK biotechnology companies. Biotechnology executives from various subsectors self-administered mailed questionnaires (Appiah-Adu and Ranchhod 1998). Appiah-Adu and Ranchhod (1998) hypothesized that MO would be positively related to new product success, growth in market share, profit margins, and overall performance. Their findings supported three of four hypotheses, specifically MO's positive relationship with growth in market share, profit margins, and overall performance (Appiah-Adu and Ranchhod 1998). No statistically significant relationship was found between MO and new product success (Appiah-Adu and Ranchhod 1998). Appiah-Adu and Ranchhod (1998) concluded that the unsupported hypothesis was a result of the peculiarities of the biotechnology industry. Specifically, Appiah-Adu and Ranchhod (1998) stated that variables other than MO may be more influential in new product success (e.g. successful clinical trials).

Similarly, De Luca, Verona, and Vicari (2010) adapted the Narver and Slater (1990) instrument to measure MO in the biotechnology industry. The authors designed new performance measures, developed from in-depth interviews with Italian biotechnology

executives. De Luca, Verona, and Vicari (2010) hypothesized that customer orientation, competitor orientation, and interfunctional coordination would be positively related to their newly developed performance construct. As with Appiah-Adu and Ranchhod (1998), De Luca, Verona, and Vicari (2010) mailed questionnaires to executives in varying subsectors of the biotechnology industry. Results supported their third hypothesis, indicating interfunctional coordination was positively and directly related to performance (De Luca, Verona, and Vicari 2010). It was found that customer orientation and competitor orientation were not positively and directly related to performance, leading to the rejection of the first and second hypotheses. When knowledge integration as a moderating variable was introduced, customer orientation showed a positive and significant contribution to performance but the competitor orientation and performance relationship was unchanged (De Luca, Verona, and Vicari 2010).

Renko, Carsrud, and Brannback (2009) adapted the Kohli and Jaworski (1990) scale to explore the relationship between MO and performance. Capital invested in the company was the main measure of performance and was adjusted based on firm size (Renko, Carsrud, and Brannback 2009). Renko, Carsrud, and Brannback (2009) hypothesized that biotechnology ventures' MO is positively associated with capital infusions. A structured questionnaire was administered in-person to CEOs or Managing Directors of human health biotechnology companies in the US, Finland, and Sweden. Human health biotechnology companies were defined as those that operated in the areas of human therapeutics, diagnostics, medical devices, and technologies. Overall, MO was found to be an antecedent to capital invested in biotechnology companies, ultimately supporting their hypothesis. However, when examined separately, the significance of the MO and performance relationship was only present among Finnish and Swedish companies. This suggests that differences, related to the strength of the

relationship between MO and performance, may exist across various national borders. Renko, Carsrud, and Brannback's (2009) findings suggest that it may be fruitful to examine the MO and performance relationship in different countries (e.g. Canada).

To date, no known study of biotechnology companies has examined the MO and performance relationship in the Canadian context. The Canadian biotechnology market is similar to Finland, Sweden, and the US, as these countries' industries are medical/healthcare-focused and dominated by SMEs (Datamonitor 2011a; Datamonitor 2011b; Datamonitor 2011c). The Canadian biotechnology industry more closely resembles the Scandinavian as opposed to the American market with respect to the market size, number of companies, and supporting industries (Datamonitor 2011a; Conference Board of Canada 2005; Industry Canada 2011b; Ernst & Young 2011; BIOTECanada 2011a; Datamonitor 2011b; Datamonitor 2011c; Biotechnology Europe 2012b; Biotechnology Europe 2012a; Canada's Venture Capital & Private Equity Association 2012; Battelle Technology Partnership Practice 2010; Datamonitor 2012a; Datamonitor 2012b; Datamonitor 2011e). In the US, the biotechnology market is valued at 84.8 billion USD, it headquarters over 1,700 biotechnology companies and more than 4,000 venture capital (VC) firms, and is the global leader in pharmaceuticals with a market value of 265 billion USD (Datamonitor 2011a; Ernst & Young 2011; Battelle Technology Partnership Practice 2010; Datamonitor 2011e). Contrarily, the Canadian, Finnish, and Swedish biotechnology markets are substantially smaller in value than their American counterpart (Datamonitor 2011b; Datamonitor 2011c). Similar to Canada's estimated 500-plus biotechnology companies, together, Sweden and Finland have just over 550 firms (Conference Board of Canada 2005; Industry Canada 2011b; BIOTECanada 2011a; Biotechnology Europe 2012b; Biotechnology Europe 2012a). Additionally, compared to the VC industry in the US, the Canadian, Finnish, and Swedish VC

markets are less established in terms of the number of companies and overall experience (Biotechnology Europe 2012b; Biotechnology Europe 2012a; Canada's Venture Capital & Private Equity Association 2012). Finally, compared to Canada and Sweden the US pharmaceutical industry is over 10 and 40 times larger respectively (Datamonitor 2011a; Datamonitor 2012a; Datamonitor 2012b). Based on the market similarities involving Canada, Finland, and Sweden, it is theorized that the MO and performance relationship in Canada will resemble the Finnish and Swedish results as opposed to the American results from the Renko, Carsrud, and Brannback (2009) study. Therefore, the foregoing discussion regarding MO and performance and the comparison of biotechnology markets led to the formulation of the first hypothesis.

Hypothesis 1: *Market orientation has a positive and significant effect on business performance*

2.2 Strategic Alliances and Performance

Strategic alliances in the North American biotechnology industry have been extensively studied in academic research (Baum, Calabrese, and Silverman 2000; Baum and Silverman 2004; Forest and Martin 1992; George et al. 2001; George, Zahra, and Wood 2002; Silverman and Baum 2002; Sarkar, Echambadi, and Harrison 2001; Standing, Standing, and Lin 2008). Furthermore, Baum, Calabrese, and Silverman (2000), Baum and Silverman (2004), and Silverman and Baum (2002) examined elements of strategic alliances in all subsectors of the Canadian biotechnology industry. In various settings involving biotechnology companies, individual strategic alliance elements have been empirically shown to have positive and direct relationships with performance (Baum, Calabrese, and Silverman 2000; Baum and Silverman 2004; Forest and Martin 1992; George et al. 2001; Sarkar, Echambadi, and Harrison 2001).

From 1991 through 1996, Baum, Calabrese, and Silverman (2000) studied strategic alliances and performances of new Canadian biotechnology companies. They found that new biotechnology companies' performance increased with the size and efficiency of the alliance networks (Baum, Calabrese, and Silverman 2000). Particularly, biotechnology companies that obtained early alliances with pharmaceutical companies experienced more patenting, a proliferation of revenue, an increase in the number of R&D and non-R&D employees, and growth in R&D spending (Baum, Calabrese, and Silverman 2000).

Baum and Silverman (2004) investigated differing types of strategic alliances and their relationship with financing and overall performance in the Canadian biotechnology industry. Strategic alliances were categorized as either horizontal or vertical. Horizontal alliances were defined as partnerships or agreements with rival biotechnology companies (Baum and Silverman 2004). Vertical alliances were further classified as either upstream or downstream agreements (Baum and Silverman 2004). Upstream alliances were agreements between biotechnology companies and "universities, research institutes, government labs, hospitals, or industry associations" (Baum and Silverman 2004, 422). Downstream alliances were defined as partnerships with firms closer to the market, including pharmaceutical, chemical, or marketing companies (Baum and Silverman 2004). Baum and Silverman (2004) found that new biotechnology ventures financially benefited most from downstream and horizontal alliances. Baum and Silverman (2004) suggest that biotechnology companies with alliances closer to the market (downstream or horizontal) raise more capital and perform well because it demonstrates legitimacy and commercial viability to VCs.

George, Zahra, Wheatley, and Khan (2001) also studied alliance types versus performance among biotechnology companies. Alliance types included horizontal, vertical,

knowledge generative, and knowledge attractive. Knowledge generative alliances pertained to partnerships or agreements involving joint R&D, and knowledge attractive alliances involved licensing or purchasing agreements (George et al. 2001). These results coincide with Baum and Silverman (2004), promoting the idea that alliances vertically downstream and closer to the market (licensing and purchasing agreements) increase the performances of biotechnology companies.

Sarkar, Echambadi, and Harrison (2001) explored the relationship between alliance proactiveness and market performance. Sarkar, Echambadi, and Harrison (2001) define alliance proactiveness as scanning the business environment for alliance opportunities and engaging in proactive activities to obtain alliances. Responses from executives in the US biotechnology industry enabled Sarkar, Echambadi, and Harrison (2001) to conclude that alliance proactiveness affects performance, and that the relationship is stronger with smaller biotechnology companies.

Contrarily, Forrest and Martin (1992) found that both small and large biotechnology companies in Canada experienced a wide array of, and arguably equally positive, outcomes from strategic alliances. Forrest and Martin (1992) caution that although small and large biotechnology companies benefited from strategic alliances, positive results did not come without considerable time and energy.

There is collective evidence showcasing how effective strategic alliance management is an antecedent to performance (Baum, Calabrese, and Silverman 2000; Baum and Silverman 2004; Forest and Martin 1992; George et al. 2001; Sarkar, Echambadi, and Harrison 2001). Based on the above findings, strategic alliance management requires the establishment of the right partnerships and agreements and the distinction between upstream, downstream, knowledge generative, and knowledge attractive alliances (Baum, Calabrese, and Silverman 2000; Baum

and Silverman 2004; George et al. 2001). Managers of biotechnology companies must also practice proactive alliance activities and devote time and energy to existing alliances in order to increase the likelihood of commercial success (Forest and Martin 1992; Sarkar, Echambadi, and Harrison 2001).

The Kandermir, Yaprak, and Cavusgil (2006) AO instrument incorporates many alliance metrics found in the works of Baum, Calabrese, and Silverman (2000), Baum and Silverman (2004), George, Zahra, Wheatley, and Khan (2001), Forrest and Martin (1992), and Sarkar, Echambadi, and Harrison (2001), as it measures environmental scanning (similar to proactiveness), alliance coordination (effective management of partnerships at differing levels of development), and alliance learning (commitment to alliances). Moreover, Simon and Francoise's (2003) four key elements of structuring alliance management include items that resemble alliance scanning (need assessments and opportunity analyses), alliance coordination (alliance objectives and alliance structuring), and alliance learning (priorities and knowledge integration), further supporting Kandermir, Yaprak, and Cavusgil's (2006) AO constructs.

To date, few empirical investigations have employed the Kandermir, Yaprak, and Cavusgil (2006) instrument to explore AO, emphasizing this project's ability to generate knowledge in an unexplored area of study. Also, no known research explores the AO and performance relationship in the biotechnology industry. Additionally, no known study has looked at the AO and performance relationship exclusively in one country (e.g. Canada) or in one biotechnology subsector (e.g. medical/healthcare). The prior review of literature regarding strategic alliances and performance led to the formulation of the second hypothesis.

Hypothesis 2: *Alliance orientation has a positive and significant effect on business performance*

2.3 Market Orientation, Alliance Orientation, and Business Performance

Marketing and strategic alliance management competencies have been cited as biotechnology industry success factors (Hourd and Williams 2008; Yim and Weston 2007), MO has been shown to increase the likelihood of commercial success in the biotechnology industry (Appiah-Adu and Ranchhod 1998; De Luca, Verona, and Vicari 2010; Renko, Carsrud, and Brannback 2009), and effective strategic alliance management has been proven to increase biotechnology companies' performance (Baum, Calabrese, and Silverman 2000; Baum and Silverman 2004; Forest and Martin 1992; George et al. 2001; Sarkar, Echambadi, and Harrison 2001). Therefore, if biotechnology companies' marketing (measured by MO) and strategic alliance management competencies (measured by AO) are strong and positive, performance is also likely to be favourable. Empirically, MO and other constructs (e.g. organizational entrepreneurship, corporate entrepreneurship, organizational flexibility, export market knowledge, quality and service, cultural affinity, and channel support) have been identified as unique and additive predictors of performance (Bhuian and Habib 2004; Barrett and Weinstein 1998; Thirkell and Dau 1998). Combining MO and AO to examine their additive effect on business performance is novel, as it is presumably an unstudied research area. The third hypothesis was developed based on evidence highlighting the importance of MO and strategic alliance management in the biotechnology industry, as well as findings from studies that examined MO and other constructs' additive effect on performance.

Hypothesis 3: *Market and alliance orientation has a positive and significant additive effect on business performance*

2.4 Purpose of Study

The purpose of this study is to test the unexplored relationship between MO, AO, and performance in the medical/healthcare subsector of the Canadian biotechnology industry. The

value of the study comes from determining if MO and AO individually and collectively are antecedents to business performance. Understanding the antecedents to commercial success has implications for many stakeholders.

2.5 Implications of Study

This study has implications for managers of biotechnology companies, angel investors financing biotechnology start-ups, venture capitalists funding biotechnology companies, pharmaceutical companies looking to partner with or acquire biotechnology ventures, universities supporting the biotechnology industry, the Federal Government of Canada, Provincial Governments of Canada, Canadian economy, biotechnology industry associations, hospitals, medical professionals, and most importantly, patients. Ultimately, a better comprehension of the antecedents to success, whether or not it is MO or AO, will have the potential to guide effective resource allocation and investment decisions, increase biotechnology commercialization success rates, stimulate the Canadian economy, and improve healthcare. In addition to the societal and economic benefits, this study contributes academically by undertaking an industry and subsector specific exploration of MO, AO, and business performance. Thereby, the study expands the scope of biotechnology marketing and strategic alliance management research and knowledge.

CHAPTER 3
METHODOLOGY

3.1 Study Design

The study design was a mail and web-based survey. Dillman's (1978) Total Design Method, a set of procedures and selectively timed mailings, was adapted and employed as it has been shown to increase postal responses (SAGE Research Methods 2011). Dillman's (1978) procedures include printing questionnaires on standard letterhead and enclosing them in standard envelopes, personalizing letters and content, and timing separate mailings (Dillman 1978). Due to cultural changes toward self-administration (Dillman 2000) and the increased use and acceptance of the Internet (Dillman 2000), a web-based option was included. This study utilized a multi-modal approach to survey executives to better understand the current business practices of medical/healthcare biotechnology companies in Canada.

Biotechnology executives (CEOs, Presidents, Vice Presidents, or Managing Directors) were identified using the Canadian Life Sciences Database and Industry Canada's Company Database. Senior executives of Canadian biotechnology companies were selected as key informants due to their comprehensive knowledge of company activities (e.g. marketing, alliance strategy, and business performance). A multi-modal design was chosen as it allows for respondent choice, autonomy, and flexibility (Dillman 2000). Interviews were considered, but due to the objectives and financial constraints of the project, a mail and web-based survey was deemed more appropriate.

3.2 Sample

The Canadian Life Sciences Database and Industry Canada's Company Directory were used to generate a mailing list of Canadian medical/healthcare biotechnology companies. The Canadian Life Sciences Database was chosen because it is available at no cost and is relatively

comprehensive (Canadian Life Sciences Database 2012). The Canadian Life Sciences Database and Industry Canada's Company Directory generated company profiles that included a business' name, brief description, subsector, senior executive contact (CEO, President, Vice President, or Managing Director), address, founding year, products in clinical phases, and stock information (if a publicly traded company) (Canadian Life Sciences Database 2012; Industry Canada 2012). However, despite their similarities, Industry Canada's Company Database produced fewer results and did not include information on companies' products in development stages (Industry Canada 2012).

Medical/healthcare firms were defined as biotechnology or biopharmaceutical companies with focuses in therapeutics/diagnostics, human R&D services, cosmetic, nutraceutical, or veterinary areas. Over the past few decades the activities of cosmetic, nutraceutical, biotechnology, and pharmaceutical companies have converged (Simon and Kotler 2003), emphasizing the necessity for this study's inclusion of all companies currently operating, or with the potential to operate, in human health areas. Using the Canadian Life Sciences Database, the aforementioned criteria was employed by filtering biotechnology companies to include only those in the categories of therapeutics/diagnostics, R&D services, cosmetic, nutraceutical, and veterinary. Secondly, companies' brief descriptions were read to confirm a medical, human health, biopharmaceutical, or pharmaceutical focus. Using Industry Canada's Company Database, the study's criteria were fulfilled by filtering results to include "medical/biotechnology/chemical" companies, followed by reading companies' of brief descriptions to confirm focuses in the medical, human health, biopharmaceutical, and pharmaceutical fields.

The Canadian Life Sciences Database assisted in the identification of 427 medical/healthcare biotechnology companies. Industry Canada's Company Database was consulted in order to cross-reference findings from the Canadian Life Sciences Database. Industry Canada's Company Database generated a total of 137 medical/healthcare biotechnology companies, demonstrating that the Canadian Life Sciences Database's was more comprehensive. Despite generating fewer results, Industry Canada's Company Database was used to identify 26 medical/healthcare biotechnology companies that were not included in the Canadian Life Sciences Database. These additional 26 medical/healthcare biotechnology companies were added to the existing list of 427 companies. The final list totaled 453 medical/healthcare biotechnology companies.

3.3 Questionnaire Development

The questionnaire was five pages in length and it was estimated that the completion time would be ten to fifteen minutes for each respondent. The questionnaire was comprised of five sections including a qualifying question, the adapted Narver and Slater (1990) MO instrument, Kandermir, Yaprak, and Cavusgil (2006) AO instrument, adapted and broadened De Luca, Verona, and Vicari (2010) R&D effectiveness instrument, and general descriptive questions. In order to ensure the inclusion of biotechnology companies located in the Province of Quebec, with the cooperation of the Université du Québec à Montréal (UQAM), the original questionnaire was translated from English (Appendix A) to French (Appendix B). As a result, the questionnaire cover pages included both the University of Saskatchewan and the UQAM logos.

3.3.1 Qualifying Question

The qualifying question was used to confirm that companies had a medical/healthcare focus. This item was designed to safeguard against including responses from non-medical/healthcare companies.

3.3.2 Market Orientation Instrument

The Narver and Slater (1990) MO instrument has been found to be superior to the instrument developed by Kohli and Jaworski (1990) (Farrell and Oczkowski 1997; Matsuno and Mentzer 2000; Cano, Carrillat, and Jaramillo 2004; Gauzente 1999; Pelham 1993). Statistically, Narver and Slater's (1990) achieved greater reliability ($\alpha = 0.88$) than Kohli and Jaworski's (1990) ($\alpha = 0.71$) MO instrument (Farrell and Oczkowski 1997; Narver and Slater 1990). Furthermore, it has been concluded that the validity of Kohli and Jaworski's (1990) MO construct is only moderately supported (Kohli, Jaworski, and Kumar 1993). Conceptually, the Narver and Slater (1990) scale better equates MO to a business' performance, as it captures the element of serving the needs of its customers (Cano, Carrillat, and Jaramillo 2004; Gauzente 1999). Furthermore, the Kohli and Jaworski (1990) MO instrument neglects to deal with external factors (e.g. competitor orientation), only focusing on information generation (Cano, Carrillat, and Jaramillo 2004). Gauzente (1999) asserts that the Narver and Slater (1990) instrument better measures current commitment to MO and the vocabulary used is much richer. Therefore, based on its conceptual and statistical superiority, only the Narver and Slater (1990) scale was used to measure MO and the instrument was modified specifically for the biotechnology industry.

Appiah-Adu and Ranchhod (1998) modified the Narver and Slater (1990) MO instrument for use in the biotechnology industry. In order to better suit the biotechnology industry, a total of three questions were eliminated and two questions were reworded. Subsequent to Appiah-Adu

and Ranchhod's (1998) modifications, coefficient alpha scores were obtained and demonstrated acceptable reliabilities ($\alpha > 0.70$). Due to its proven and successful application in the biotechnology industry, the Appiah-Adu and Ranchhod (1998) adapted version of Narver and Slater's (1990) MO instrument was utilized (Appendix C). For scale-size congruency with other instruments, the MO instrument was collapsed from a seven- to a five-point Likert scale, as the AO instrument cannot be expanded from a five- to a seven-point scale.

3.3.3 Alliance Orientation Instrument

As discussed, the Kandemir, Yaprak, and Cavusgil (2006) AO instrument measures alliance scanning, coordination, and learning. Alliance scanning is the first component of AO and it measures a firm's ability to identify new partners, gather new information about existing alliances, and engage in newly emerging alliance opportunities (Kandermir, Yaprak, and Cavusgil 2006). Sarkar, Echambadi, and Harrison (2001) emphasized the importance of alliance scanning as they found alliance proactiveness perpetuated performance. Alliance coordination involves managing various activities across differing alliances, employing appropriate strategies with partners, and transferring knowledge to alliance members. Baum, Calabrese, and Silverman (2000), Baum and Silverman (2004), and George, Zahra, Wheatley, and Khan (2001) discuss the complexities and importance of alliance management, legitimizing Kandemir, Yaprak, and Cavusgil's (2006) second component of alliance coordination. Alliance learning is the final component of Kandemir, Yaprak, and Cavusgil's (2006) AO instrument. Alliance learning measures the experiences and learning processes of alliance members. Forrest and Martin (1992) indirectly support Kandemir, Yaprak, and Cavusgil's (2006) alliance learning component by stressing the importance of effort and commitment in alliance relationships. Conceptually, the Kandemir, Yaprak, and Cavusgil (2006) AO instrument is appropriate for the biotechnology

industry because its components are supported by previous industry-related research regarding strategic alliances and performance.

Empirical work utilizing the Kandemir, Yaprak, and Cavusgil (2006) AO instrument is fairly limited. Kandemir, Yaprak, and Cavusgil (2006) used the instrument to explore AO and performance among technology companies. Technology companies from the chemical, manufacturing, electronic, and computer industries were selected for their study. A total of 182 usable responses were obtained in order to test their hypotheses. Kandemir, Yaprak, and Cavusgil's (2006) findings showed that AO is positively and directly related to alliance performance and indirectly related, through alliance performance as a moderator, to market performance.

Sarkar, Aulakh, and Madhok (2004) leveraged two of the developed components, namely alliance scanning and alliance coordination, when they explored their relationship with alliance capital. Unlike Kandemir, Yaprak, and Cavusgil (2006), the research was conducted with multi-industry respondents and the components were used individually to test hypotheses. Findings showed a positive direct relationship between alliance scanning and alliance capital, and alliance coordination and alliance capital.

Kandemir, Yaprak, and Cavusgil (2006) and Sarkar, Aulakh, and Madhok (2004) obtained acceptable reliability, demonstrating construct rigor collectively and independently. Furthermore, the measures prove to be successful measuring different performance constructs. Therefore, the original five-point Kandemir, Yaprak, and Cavusgil (2006) AO instrument (Appendix D) was employed to explore the relationship with business performance in Canada's medical/healthcare biotechnology industry.

3.3.4 Business Performance Instrument

In MO and strategic alliance research, performance has been measured objectively, subjectively, and with differing instruments. Frequently, performance measurements have included return-on-investment, return-on-assets, new product success, profitability, and sales revenue (Appiah-Adu 1998; Greenley 1995; Han, Kim, and Srivastava 1998; Harris 2001; Zhang 2009). Commonly, performance elements have been measured subjectively, by asking respondents to rate company performance relative to its competitors (Appiah-Adu 1998; Greenley 1995; Harris 2001; Zhang 2009; Lukas and Ferrell 2000). The works of Dess and Robinson (1984), Robinson and Pearce (1988), and Venkatraman and Ramanujam (1986) have been cited as justification for the use of subjective measures. Specifically, they found strong correlations between subjective responses and objective measures of firm performance (Venkatraman and Ramanujam 1986; Dess and Robinson 1984; Robinson and Pearce 1988). The use of a subjective performance measure is also supported when access to objective performance data is limited. As many Canadian biotechnology companies are SMEs or not publicly traded, it is necessary to employ subjective performance measures (Conference Board of Canada 2005; Datamonitor 2011b; Rajamaki 2008; Canadian Life Sciences Database 2012).

Appiah-Adu and Ranchhod (1998) expressed their concerns related to the difficulty of obtaining objective performance data in the biotechnology industry. In the Appiah-Adu and Ranchhod (1998) study of UK biotechnology companies, respondents rated company performance relative to competitors' new product success, growth in market share, profit margins, and overall performance. De Luca, Verona, and Vicari (2010), support Appiah-Adu and Ranchhod's (1998) justification for their use of subjective performance measurements in the biotechnology industry. However, De Luca, Verona, and Vicari (2010) stress the need for

redefining and using industry specific measures of performance when studying biotechnology companies.

Performance measurements related to patents, products, capital raised, milestones met, networks and alliances, mergers and acquisitions, and licensing agreements have been used and suggested as more appropriate measures of biotechnology performance (Baum, Calabrese, and Silverman 2000; George et al. 2001; George, Zahra, and Wood 2002; De Luca, Verona, and Vicari 2010; Renko, Carsrud, and Brannback 2009; Sarkar, Echambadi, and Harrison 2001; Cumby and Conrod 2001; Folta, Cooper, and Baik 2006; Lazzarotti, Manzini, and Mari 2011; Stuart and Sorenson 2003). De Luca, Verona, and Vicari's (2010) R&D effectiveness scale captures many of the mentioned elements desired for a biotechnology performance construct (Appendix E). For this study, the De Luca, Verona, and Vicari (2010) instrument was adapted to include items related to capital, alliances and partnerships, and milestones, broadening the construct to capture overall biotechnology performance (PERF) (Appendix F). For consistency with the other instruments (MO and AO), the newly constructed PERF instrument was a five-point Likert scale.

3.3.5 Descriptive Items

Descriptive items allowed for a comparison of the companies' locations, science park affiliations or non-affiliations, association memberships (e.g. BIOTECanada), ownership structures (e.g. publicly traded), executives' educational backgrounds (e.g. MBA), founding years, and number of employees.

3.3.5.1 Descriptive items one, two, and three

The first three descriptive items identify companies' locations, science park affiliations, and biotechnology association memberships. These items were included because in certain settings, positive externalities and economic benefits originate from geographically clustering

around, and knowledge sharing with, other technology-intensive companies (Efendioglu 2005). In a study of the US biotechnology industry, companies that geographically clustered experienced economies of agglomeration, enhanced their ability to attract alliance partners, obtained private equity, and innovated through partnering (Folta, Cooper, and Baik 2006). However, Folta, Cooper, and Baik (2006) found that economies of agglomeration provided economic benefits for companies only up to a certain cluster size. Specifically, when clusters of biotechnology companies became too large, diseconomies of agglomeration occurred (Folta, Cooper, and Baik 2006).

Descriptive items two and three were used as independent variables when analyzing their importance, or lack of importance, in determining MO, AO, and PERF (dependent variables) in the Canadian medical/healthcare biotechnology industry. The three descriptive items were used with the other items to generate a profile of Canadian biotechnology companies.

3.3.5.2 Descriptive item four

The fourth descriptive item was included to determine companies' ownership types. Differences in ownership structures have been shown to influence biotechnology companies' corporate strategies and performance (Baum, Calabrese, and Silverman 2000; Stuart, Hoang, and Hybels 1999; Zahra 1996). In a study of American biotechnology companies, it was found that R&D, patenting, and technology management strategies differed based on ownership types (Zahra 1996). Zahra (1996) found that independently owned biotechnology ventures outperformed corporate-sponsored biotechnology ventures on a variety of metrics. Stuart (1999) showed that biotechnology companies that had established partners, issued stock more quickly and had higher valuations than companies without such partners. An analysis of young Canadian biotechnology companies demonstrated how differing ownership types and alliances led to dissimilar focuses, specializations, and performance (Baum, Calabrese, and Silverman 2000).

Descriptive item four was used as an independent variable to analyze its importance, or lack of importance, in determining MO, AO, and PERF (dependent variables) in the Canadian medical/healthcare biotechnology industry. The fourth descriptive item was also used with the other items to generate a profile of Canadian biotechnology companies

3.3.5.3 Descriptive item five

The fifth descriptive item was included to determine CEOs' educational backgrounds. There is much debate over the importance of the educational backgrounds of biotechnology CEOs. Kermani and Gittins (2004) discuss how joint natural science and business educational programs can increase the managerial talents of biotechnology executives. They concluded by recommending that biotechnology executives with educational backgrounds in natural science or engineering should be exposed to formal business training (Kermani and Gittins 2004). McMillan (2005) highlights that many biotechnology companies' executives are PhD natural scientists and may lack experience in bringing products to the market and reaching profitability. In McMillan's (2005) study of US publicly traded biotechnology companies, firms headed by CEOs with natural science PhDs had lower market valuations than firms headed by CEOs with other educational backgrounds. Yet, companies led by CEOs with natural science PhDs tended to produce "higher-impact" patents than companies led by CEOs with other educational backgrounds (McMillan and Thomas 2005). McMillan (2005) concluded that stock markets favour companies that are led by professional managers and the market does not base market valuations solely on science or technology. Contrary to McMillan's (2005) findings, in a study of American and European biotechnology companies, educations of CEOs played no role in the financial performance of their companies (Patzelt 2010).

The fifth descriptive item was used with the other items to generate a profile of Canadian biotechnology companies. More importantly, descriptive item five was used as an independent

variable to analyze its importance, or lack of importance, in determining MO, AO, and PERF (dependent variables) in the Canadian medical/healthcare biotechnology industry.

3.3.5.4 Descriptive items six and seven

Descriptive item six was designed to collect information on companies' founding years. McMillan (2005) found that US stock markets favoured older and more established biotechnology enterprises. Descriptive item seven was designed to collect information on companies' number of employees. In Canada, most biotechnology companies are SMEs (Conference Board of Canada 2005; Datamonitor 2011b; Rajamaki 2008; Government of Canada 2012; BIOTECanada 2011b). Woiceshyn and Hartel (1996) compared small, medium, and large Canadian biotechnology companies' performance using subjective sales measures. It was found sales performance increased with company size (Woiceshyn and Hartel 1996). Although these findings suggest that companies that are older and have more employees outperform companies that are smaller and have fewer employees, both studies only measured performance financially.

Descriptive items six and seven were used as independent variables to analyze their importance, or lack of importance, in determining overall biotechnology performance (PERF), MO, and AO. Descriptive items six and seven were also used with the other items to generate a profile of Canadian biotechnology companies.

3.4 Questionnaire Distribution and Data Collection

On May 28, 2012, the first mailing of the questionnaire was sent to the 453 identified medical/healthcare biotechnology companies in Canada. Each package included a cover letter (Appendices G & H), the questionnaire (Appendices A & B), and a paid-postage return envelope. The cover letters were personally addressed to a senior executive, written on University of Saskatchewan letterhead, and included the link to the online questionnaire

(https://survey.qualtrics.com/SE/?SID=SV_5hFkveDPwEF0HxW). The questionnaires were printed on green paper in order to attract attention and contrast other documents. Two weeks after the first mailing, reminder postcards (Appendices I & J) were sent to executives that had not yet responded. The reminder postcards were printed on green cardstock paper and included the link to the online questionnaire. Two weeks following the mailing of the reminder postcard, the second mailing of the questionnaire was sent to those who had not responded. The contents of the second mailing of the questionnaire were similar to the initial mailing, as it included a cover letter (Appendices K & L), the questionnaire, and a paid-postage return envelope. Seeing as the survey was conducted over the summer months, data collection was extended. Data collection officially concluded on August 31, 2012.

Table 3.1 Data Collection Timeline

Date	Activity
May 28, 2012	First wave of questionnaires mailed
June 11, 2012	Reminder postcard mailed
June 25, 2012	Second wave of questionnaires mailed
August 31, 2012	Data collection concluded

3.5 Data Analyses

Data analyses were accomplished with the use of Statistical Package for the Social Sciences (SPSS© Version 20.0 for Mac OS). The response rate was tabulated, demographic and instrument results were generated, reliability analyses were performed, factor analyses were conducted, the presence of a non-response bias was examined, discriminant validity was tested, analyses of the descriptive items were performed, and hypotheses were investigated.

Demographic results were used to generate a profile of Canadian medical/healthcare biotechnology companies. The instrument results allowed for a quantitative description of the

data, particularly the way respondents answered questions related to their companies' MO, AO, and PERF.

The internal reliability of the MO, AO, and PERF instruments were conducted using reliability analyses. Alpha coefficients greater than 0.70 but less than 0.80 were acceptable, greater than 0.80 but less than 0.90 were good, and scores higher than 0.90 were excellent (George and Mallery 2009). Due to the extensive use of Narver and Slater's (1990) MO instrument and the advanced practices of MO research, higher Cronbach's alpha coefficients could be expected. However, for exploratory work in new areas of research (e.g. Canadian medical/healthcare biotechnology industry) a coefficient of 0.70 is cited as an acceptable measure of a construct's internal reliability (Nunnally 1978). Therefore, despite the extensive use of Narver and Slater's (1990) MO instrument, this study's goal was to obtain internal reliabilities that met or exceeded coefficients of 0.70. Using the MO instrument in the Canadian medical/healthcare biotechnology industry is an unexplored research area, demonstrating the appropriateness for the stipulated Cronbach's alpha coefficient ($\alpha = 0.70$). Due to limited research using the Kandemir, Yaprak, and Cavusgil (2006) and the De Luca, Verona, and Vicari (2010) instruments, obtaining a Cronbach's alpha coefficient of 0.70 or better was also appropriate and justified (Nunnally 1978).

"Factor analysis is conducted to discover what latent variables (factors) are behind a set of variables or measures" (SAGE Research Methods 2012a). Factor analyses were conducted on MO, AO, and PERF in order to test the dimensionality of the constructs.

Kwak and Radler (2002) found that response rates and the respondents themselves (e.g. Internet users and non-users) differed based on data collection formats (e.g. mail and web-based) (Kwak and Radler 2002). Therefore, mail and online responses were analyzed and compared to

determine if any statistically significant differences existed among respondent groups. Due to the financial constraints of the research project, the mailing of a non-responder questionnaire was not undertaken. According to Armstrong and Overton (1977), subjects that respond later, as opposed to earlier, more closely resemble non-responders. Therefore, in the absence of non-responder questionnaires, key constructs can be compared among early and late responses to determine the existence of a non-response bias (Armstrong and Overton 1977). In lieu of a non-responder questionnaire, key constructs (MO, AO, and PERF) were compared among early and late responders to determine the potential existence of a non-response bias.

Discriminant validity tests if a measure or construct is unrelated to other measures or constructs (Carless 2012). "Correlation coefficients between measures of a construct and measures of conceptually different constructs are usually given as evidence of discriminant validity" (Carless 2012). If correlation coefficients are high it demonstrates a lack of discriminant validity and if correlation coefficients are low or moderate it demonstrates discriminant validity (Carless 2012). According to Kline (2005), if a construct's 90 percent confidence interval does not contain the number one, discriminant validity has been achieved (Kline 2005). The discriminant validity of MO and AO was tested in order to determine if the constructs measured different phenomena.

Descriptive analyses were conducted using the descriptive data as independent variables and the three major constructs as dependent variables (MO, AO, and PERF). The additional analyses were designed to confirm or refute previous findings related to the importance of clustering, ownership structures, educational backgrounds of CEOs, and company ages and sizes in the biotechnology industry.

The set of hypotheses explored the relationship between biotechnology companies' MO and PERF (H1), AO and PERF (H2), and MO, AO, and PERF (H3) (Appendix M). Using linear regression, hypothesis testing was accomplished using the unweighted means of constructs, employing listwise deletion as the method to treat missing data. Listwise deletion was used because the sample had limited missing data and it has been cited as preferable to many other methods (Allison 2002). Independent variables were MO and AO, and the dependent variable was PERF. According to G*Power's (1996) a priori multiple linear regression, employing Cohen's (1988) minimum power requirement ($1-\beta = 0.80$) and standard error probability ($\alpha = 0.05$), a sample size of 68 was required in order to detect a medium-sized effect ($f^2 = 0.15$) of two predictor independent variables (MO and AO) on a dependent variable (PERF) (Erdfelder, Faul, and Buchner 1996; Cohen 1988). Although it is hypothesized that MO and AO would be significant predictors of PERF, a medium-sized effect ($f^2 = 0.15$) was theorized because it is likely that there are other possible variables influencing business performance.

If MO had a statistically significant influence on PERF (H1) and AO had a statistically significant influence on PERF (H2), but either MO or AO became non-significant when examined together (H3), a mediation relationship may have existed (Baron and Kenny 1986). In order to confirm or refute the existence of a mediation relationship, a final mediation regression analysis was performed. This regression analysis used the third hypothesis' non-significant predictor as independent variable and its statistically significant predictor as the dependent variable (Baron and Kenny 1986). If the relationship was positive and statistically significant, a mediation relationship existed (Baron and Kenny 1986).

3.6 Ethical Considerations

On April 4, 2012 a research ethics application was submitted to the University of Saskatchewan Behavioural Research Ethics Board. The research project was deemed exempt

(BEH 12-104) from the ethics review process on April 9, 2012. The exemption was granted due to the project's focus on business practices as opposed to human behaviour.

CHAPTER 4
RESULTS

4.1 Response Rate

Two weeks after the initial mailing, 13 responses and seven return-to-sender packages were received. Therefore, 433 reminder postcards were sent to companies that had not yet responded. Between the mailing of the reminder postcards and the second wave of questionnaires, 39 responses and 27 return-to-sender packages were received. Four weeks after the initial packages were posted, the second mailing of the questionnaires were sent to the 367 companies that had not yet responded. From the second mailing of the questionnaires to the end of data collection, 35 responses and 19 return-to-sender packages were received.

At the end of data collection a total of 87 responses and 53 return-to-sender packages were received. Six of the 87 responses explicitly stated that the focus of the biotechnology company was not, nor did it have the potential to become, medical/healthcare focused. These six were then removed, reducing the number of usable responses and sample size to 81 and 447 respectively. Upon receiving the return-to-sender packages, online searches were conducted in order to determine the status of the companies. From the searches it was found that the companies had merged, been acquired, filed for bankruptcy, suspended trading, moved, or dissolved. These 53 companies were subsequently removed from the sample, further reducing its size to 394. Therefore, the response rate of the project was 20.6% (81/394).

4.2 Demographic Results

The following sections explore the demographic results including the response language, method of completion, company location, number of association memberships, company ownership structure, executive educational background, company founding year, and company size.

4.2.1 Response Language

Companies located in Quebec received cover letters, questionnaires, and reminder postcards written in French. Companies located in all other provinces received cover letters, questionnaires, and reminder postcards written in English. One company, located in Quebec, requested that an English-version of the questionnaire be electronically mailed for its completion. Out of the 81 responses, 67 (82.7%) were completed in English and 14 (17.3%) were completed in French. The percentage of responses from Quebec companies (14/81, 17.3%) was slightly less than the percentage of French questionnaires mailed to companies in Quebec (101/394, 25.6%).

4.2.2 Method of Completion

Executives were provided mail and web-based completion options. The number of mail and online responses were 61 (75.3%) and 20 (24.7%) respectively.

4.2.3 Company Location

The first question related to companies' locations asked respondents if their company was headquartered in Canada. Seventy-four companies (91.4%) were, and six (7.4%) were not, headquartered in Canada. Of the six companies not headquartered in Canada, three were Canadian subsidiaries (e.g. Biotechnology Enterprise Canada). Although these six companies were not headquartered in Canada, they had Canadian addresses and operated within the country. Due to the fact that all companies operated within Canada, all 81 responses were included.

In order to determine approximate locations (e.g. city and province) of companies, respondents were asked to give the first three characters of their postal codes. Four major response-based clusters were identified, including Lower Mainland, Edmonton, Toronto, and Montreal/Laval (Appendix N). Table 4.1 displays the companies in each province as compared to the responses from province. The majority of responses were received from Ontario (32.1%),

British Columbia (25.9%), and Quebec (18.5%). It is important to note that the number of responses from companies located in Quebec differs from the number of French responses. This incongruence was due to the Quebec-based company asking for an English version of the questionnaire, thereby being included as a Quebec, but not a French, response.

Table 4.1 Provincial Responses and Companies

Province	Companies N (%)	Responses N (%)
British Columbia	85 (21.6)	21 (25.9)
Alberta	29 (7.4)	12 (14.8)
Saskatchewan	4 (1)	1 (1.2)
Manitoba	8 (2)	1 (1.2)
Ontario	152 (38.6)	26 (32.1)
Quebec	100 (25.4)	15 (18.5)
New Brunswick	3 (0.8)	0 (0)
Prince Edward Island	3 (0.8)	2 (2.5)
Nova Scotia	9 (2.3)	3 (3.7)
Newfoundland and Labrador	1 (0.3)	0 (0)
Total	394 (100)	81 (100)

The third location question asked respondents if their company was located in a biotechnology or science park. Twenty-seven companies (33.3%) were, and 53 companies (65.4%) were not, located in a biotechnology or science park.

4.2.4 Association Memberships

In the questionnaire, executives were asked to check all of the pharmaceutical and biotechnology associations for which their company held memberships. Of the 81 companies that responded, 64 (79%) held at least one pharmaceutical or biotechnology association membership. Membership categories ranged from zero to four or more pharmaceutical or biotechnology association memberships. Table 4.2 displays responses by number of memberships.

Table 4.2 Association Memberships

Number of memberships	Responses N (%)
0	17 (21.0)
1	25 (30.9)
2	16 (19.7)
3	16 (19.7)
≥ 4	7 (8.6)
Total	81 (100)

4.2.5 Ownership Structure

Originally, ownership structures were classified into five categories including privately owned, publicly traded, subsidiary, government, and other. The government category was omitted, as no respondent classified its organization as a government enterprise. The other category was omitted and replaced with non-profit, because the only company in the other category was a non-profit organization. Table 4.3 presents responses by ownership type.

Table 4.3 Ownership Structure

Ownership	Responses N (%)
Privately owned	61 (75.3)
Publicly traded	13 (16.0)
Subsidiary	4 (4.9)
Non-Profit	1 (1.2)
Missing data	2 (2.5)
Total	81 (100)

4.2.6 CEO's Education

Respondents were asked to state their CEO or President's educational background. Responses varied greatly from specific degrees and majors (e.g. MBA in Finance) to simply areas of study (e.g. business). Educational backgrounds were subsequently classified into seven categories including arts, business, doctoral, engineering, medical, science, and hybrid. The

hybrid category was created as many executives (16%) were dually trained in science and business or law. Seeing as the questionnaires were disseminated to the senior executives listed in the Canadian Life Sciences Database and Industry Canada's Company Database, not all contacts were the CEO or President. Four respondents (4.9%) indicated that they did not know the CEO or President's educational background. In these cases, an unknown was explicitly different than a missing response. Table 4.4 outlines responses by CEO or President's educational backgrounds.

Table 4.4 CEO or President's Education

Education	Responses N (%)
Arts (BA)	4 (4.9)
Business (BComm, MBA)	8 (9.9)
Doctoral (PhD)	33 (40.7)
Engineering (PEng, MEng)	3 (3.7)
Medical (MD)	7 (8.6)
Science (BSc, MSc)	7 (8.6)
Hybrid (MBA & PhD)	13 (16.0)
Unknown	4 (4.9)
Missing data	2 (2.5)
Total	81 (100)

4.2.7 Company Age

The mean, median, and mode ages of the companies were 12.7, 10.5, and 6 years respectively. Companies were grouped in five-year increments based on their founding years, beginning with companies founded prior to 1985 to ones founded after 2011 (Table 4.5). The majority of companies were founded between 1996 and 2010.

Table 4.5 Founding Year

Founding year	Responses N (%)
Prior to 1985	7 (8.6)
1986 – 1990	7 (8.6)
1991 – 1995	8 (9.9)
1996 – 2000	15 (18.5)
2001 – 2005	15 (18.5)
2006 – 2010	26 (32.1)
2011 or after	2 (2.5)
Missing data	1 (1.2)
Total	81 (100)

4.2.8 Company Size

According to Industry Canada (2011), organizational size categories are micro (1 to 4 employees), small (5 to 99 employees), medium (100 to 499 employees), and large (≥ 500 employees) (Industry Canada 2011a). Based on the defined categories, the majority of responses were from small (71.6%) companies. Table 4.6 displays responses by Industry Canada's employment size categories.

Table 4.6 Company Size

Employment size category (Number of employees)	Responses N (%)
Micro (1 – 4)	13 (16.0)
Small (5 – 99)	59 (72.8)
Medium (100 – 499)	4 (4.9)
Large (≥ 500)	3 (3.7)
Missing data	2 (2.5)
Total	81 (100)

4.3 Instrument Results

4.3.1 Market Orientation

As previously discussed (3.3.2 Market Orientation Instrument), the 12-item adapted MO instrument (Appendix C) was utilized for this study. Responses to items four, six, seven, and nine were weighted toward *to a moderate extent/to a considerable extent* (Table 4.7). Responses to the remaining items were weighted toward *to a considerable extent/to a great extent* (Table 4.7). Of the 81 responses, the mean, median, mode, and standard deviation was 3.81, 3.92, 3.75, and 0.71 respectively.

Table 4.7 Market Orientation

	To no extent N (%)	To a small extent N (%)	To a moderate extent N (%)	To a considerable extent N (%)	To a great extent N (%)	Total N (%)
(1) Our business objectives are driven primarily by customer satisfaction	7 (8.6)	7 (8.6)	9 (11.1)	19 (23.5)	38 (46.9)	80 (98.8)
(2) Our strategy for competitive advantage is based on our understanding of customers' needs	3 (3.7)	1 (1.2)	9 (11.1)	26 (32.1)	41 (50.6)	80 (98.8)
(3) Our business strategies are driven by our beliefs about how we can create greater value for customers	2 (2.5)	2 (2.5)	7 (8.6)	20 (24.7)	49 (60.5)	80 (98.8)
(4) We measure customer satisfaction systematically and frequently	16 (19.8)	9 (11.1)	23 (28.4)	20 (24.7)	12 (14.8)	80 (98.8)
(5) All business functions share information concerning competitors' strategies	3 (3.7)	10 (12.3)	16 (19.8)	28 (34.6)	23 (28.4)	80 (98.8)
(6) We rapidly respond to competitive actions that threaten us	3 (3.7)	7 (8.6)	25 (30.9)	28 (34.6)	17 (21)	80 (98.8)
(7) Top managers regularly discuss competitors' strengths and strategies	2 (2.5)	6 (7.4)	22 (27.2)	35 (43.2)	16 (19.8)	81 (100)
(8) We target customers where we have an opportunity for competitive advantage	1 (1.2)	3 (3.7)	7 (8.6)	32 (39.5)	37 (45.7)	80 (98.8)
(9) We freely communicate information about our success and unsuccessful customer experiences across all business functions	10 (12.3)	5 (6.2)	24 (29.6)	25 (30.9)	17 (21)	81 (100)
(10) All business functions (e.g. marketing/sales, manufacturing, R&D, finance/accounting, etc.) are integrated in serving the needs of our target markets	2 (2.5)	6 (7.4)	15 (18.5)	32 (39.5)	26 (32.1)	81 (100)
(11) All business functions understand how everyone in our business can contribute to creating customer value	2 (2.5)	5 (6.2)	18 (22.2)	27 (33.3)	29 (35.8)	81 (100)
(12) We share resources with other business units	10 (12.3)	5 (6.2)	12 (14.8)	33 (40.7)	20 (24.7)	80 (98.8)

4.3.2 Alliance Orientation

As previously discussed (3.3.3 Alliance Orientation Instrument), the nine-item AO instrument (Appendix D) was utilized in this study. Responses to items one, two, three, and nine

were weighted toward *agree/strongly agree* (Table 4.8). Responses to the remaining items were weighted toward *neutral/agree* (Table 4.8). Of the 80 responses, the mean, median, mode, and standard deviation was 3.89, 4.00, 4.00, and 0.70 respectively.

Table 4.8 Alliance Orientation

	Strongly disagree N (%)	Disagree N (%)	Neutral N (%)	Agree N (%)	Strongly agree N (%)	Total N (%)
(1) We actively monitor our environment to identify partnering opportunities	0 (0)	3 (3.7)	5 (6.2)	32 (39.5)	40 (49.4)	80 (98.8)
(2) We routinely gather information about prospective partners from various forums (e.g. trade shows, industry conventions, databases, publications, internet, etc.)	0 (0)	4 (4.9)	5 (6.2)	32 (39.5)	39 (48.1)	80 (98.8)
(3) We are alert to market developments that create potential alliance opportunities	0 (0)	3 (3.7)	4 (4.9)	44 (54.3)	29 (35.8)	80 (98.8)
(4) Our activities across different alliances are well coordinated	0 (0)	7 (8.6)	27 (33.3)	28 (34.6)	18 (22.2)	80 (98.8)
(5) We systematically coordinate our strategies across different alliances	0 (0)	8 (9.9)	25 (30.9)	28 (34.6)	18 (22.2)	79 (97.5)
(6) We have processes to systematically transfer knowledge across alliance partners	1 (1.2)	12 (14.8)	28 (34.6)	25 (30.9)	13 (16)	79 (97.5)
(7) We conduct periodic reviews of our alliances to understand what we are doing right and what we are doing wrong	1 (1.2)	8 (9.9)	23 (28.4)	32 (39.5)	15 (18.5)	79 (97.5)
(8) We periodically collect and analyze field experiences from our alliances	1 (1.2)	8 (9.9)	26 (32.1)	30 (37)	14 (17.3)	79 (97.5)
(9) We modify our alliance related procedures as we learn from experience	1 (1.2)	6 (7.4)	16 (19.8)	39 (48.1)	17 (21)	79 (97.5)

4.3.3 Business Performance

As previously discussed (3.3.4 Business Performance Instrument), the newly constructed eight-item PERF instrument (Appendix F) was utilized in this study. Responses to item eight

were weighted toward *to a moderate extent/to a considerable extent* (Table 4.9). The majority of responses to the items were weighted toward *to a considerable extent/to a great extent* (Table 4.9). Of the 79 responses, the mean, median, mode, and standard deviation was 3.76, 3.88, 4.25, and 0.77 respectively.

Table 4.9 Business Performance

	To no extent N (%)	To a small extent N (%)	To a moderate extent N (%)	To a considerable extent N (%)	To a great extent N (%)	Total N (%)
(1) Generation of new innovative products or projects	1 (1.2)	3 (3.7)	14 (17.3)	30 (37)	31 (38.3)	79 (97.5)
(2) New patents	14 (17.3)	6 (7.4)	12 (14.8)	15 (18.5)	31 (38.3)	78 (96.3)
(3) Quality and relevance of scientific output	0 (0)	2 (2.5)	16 (19.8)	34 (42)	27 (33.3)	79 (97.5)
(4) Attainment of scientific results or milestones	1 (1.2)	3 (3.7)	17 (21)	32 (39.5)	26 (32.1)	79 (97.5)
(5) Recruitment of new personnel with outstanding knowledge and skills	4 (4.9)	6 (7.4)	17 (21)	32 (39.5)	20 (24.7)	79 (97.5)
(6) Scientific or technological leadership in your environment	0 (0)	4 (4.9)	20 (24.7)	31 (38.3)	24 (29.6)	79 (97.5)
(7) Attainment of new capital, either public or private	14 (17.3)	12 (14.8)	15 (18.5)	18 (22.2)	19 (23.5)	78 (96.3)
(8) Maintenance and generation of alliances or partnerships	8 (9.9)	7 (8.6)	19 (23.5)	29 (35.8)	16 (19.8)	79 (97.5)

4.4 Analysis of Instruments

4.4.1 Market Orientation

According to Narver and Slater (1990), "the theory of market orientation suggests that the three behavioral components are equally important" (Narver and Slater 1990, 26). As Narver and Slater (1990) viewed customer orientation, competitor orientation, and interfunctional coordination as equally important, they measured MO by using the unweighted mean score of the components.

4.4.1.1 MO reliability

In order to evaluate the internal reliability of the MO instrument, a reliability analysis was undertaken. The 12-item MO instrument's Cronbach's alpha was 0.876, thereby exceeding the previously defined requirement ($\alpha \geq 0.70$). Table 4.10 shows how Cronbach's alpha would change if any of the 12 items were deleted.

Table 4.10 MO Total Statistics

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
Our business objectives are driven primarily by customer satisfaction	41.91	58.005	0.630	0.639	0.863
Our strategy for competitive advantage is based on our understanding of customers' needs	41.61	62.004	0.589	0.702	0.865
Our business strategies are driven by our beliefs about how we can create greater value for customers	41.48	63.674	0.504	0.518	0.870
We measure customer satisfaction systematically and frequently	42.77	57.655	0.642	0.516	0.862
All business functions share information concerning competitors' strategies	42.14	62.203	0.516	0.478	0.870
We rapidly respond to competitive actions that threaten us	42.31	62.770	0.519	0.401	0.869
Top managers regularly discuss competitors' strengths and strategies	42.14	62.414	0.645	0.607	0.863
We target customers where we have an opportunity for competitive advantage	41.64	64.971	0.460	0.448	0.872
We freely communicate information about our success and unsuccessful customer experiences across all business functions	42.44	58.408	0.653	0.558	0.861
All business functions (e.g. marketing/sales, manufacturing, R&D, finance/accounting, etc.) are integrated in serving the needs of our target markets	41.95	62.155	0.566	0.460	0.867
All business functions understand how everyone in our business can contribute to creating customer value	41.94	60.272	0.689	0.587	0.860
We share resources with other business units	42.25	61.609	0.456	0.467	0.875

As outlined prior to undertaking the reliability analysis (3.5 Data Analyses), the criterion of a Cronbach's alpha coefficient of 0.70 or higher for the MO instrument was achieved ($\alpha = 0.876$).

4.4.1.2 MO factor analysis

Factor analysis was conducted in order to test the dimensionality of the MO construct. The result of the factor analysis suggested that there were two factors. The first factor was dominant as it accounted for 43.3 percent of the variance, while the second factor accounted for 15.9 percent of the variance (Figure 4.1). The principal component analysis (Table 4.11) showed all item-loading to the first component was above, or equal to, 0.544. The loading on the second component was sporadic, showing no clear pattern.

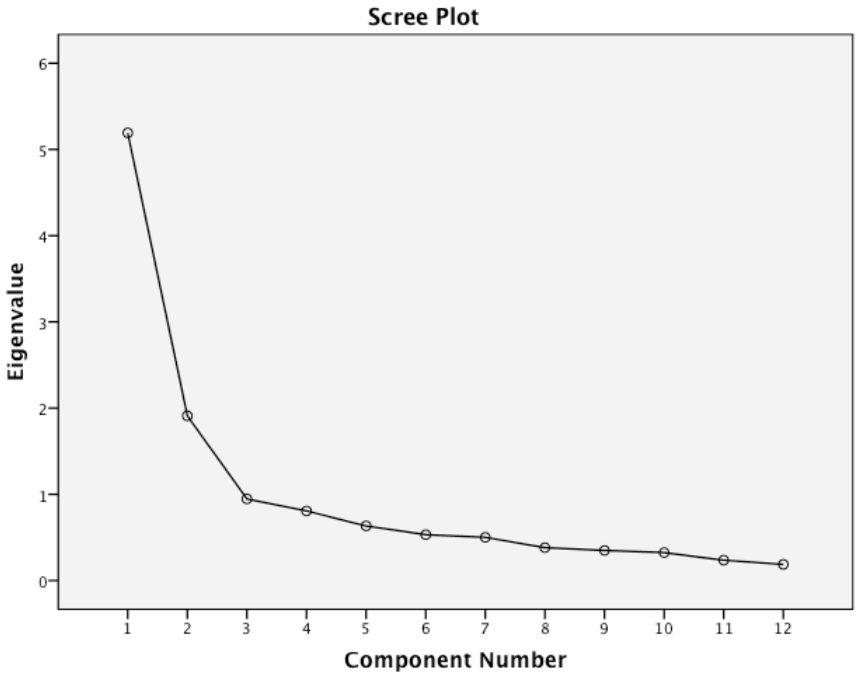


Figure 4.1 Market Orientation Scree Plot

Table 4.11 Market Orientation Component Matrix[a]

	Component	
	1	2
All business functions understand how everyone in our business can contribute to creating customer value	0.760	
We freely communicate information about our success and unsuccessful customer experiences across all business functions	0.726	
We measure customer satisfaction systematically and frequently	0.719	
Our business objectives are driven primarily by customer satisfaction	0.716	-0.454
Top managers regularly discuss competitors' strengths and strategies	0.712	0.417
Our strategy for competitive advantage is based on our understanding of customers' needs	0.675	-0.589
All business functions (e.g. marketing/sales, manufacturing, R&D, finance/accounting, etc.) are integrated in serving the needs of our target markets	0.654	
We rapidly respond to competitive actions that threaten us	0.607	
Our business strategies are driven by our beliefs about how we can create greater value for customers	0.594	-0.559
All business functions share information concerning competitors' strategies	0.593	0.482
We target customers where we have an opportunity for competitive advantage	0.546	
We share resources with other business units	0.544	0.583

Extraction Method: Principal Component Analysis
a. 2 components extracted

4.4.1.3 MO instrument conclusion

Based on Narver and Slater's (1990) theoretical conceptualization of MO and results of the reliability and factor analysis, an unweighted average of MO's 12 items was used as a composite index score to represent the construct in subsequent analyses.

4.4.2 Alliance Orientation

Kandermir, Yaprak, and Cavusgil (2006) "conceptualized alliance orientation as a competency that tends to increase in magnitude as each of the three fundamental alliance-driven capabilities, alliance scanning, alliance coordination, and alliance learning, increases" (Kandermir, Yaprak, and Cavusgil 2006, 331). As Kandermir, Yaprak, and Cavusgil (2006)

viewed the AO construct as a composite of alliance scanning, alliance coordination, and alliance learning, they measured AO by using the unweighted mean score of the nine items.

4.4.2.1 AO reliability

In order to evaluate the internal reliability of the AO instrument, a reliability analysis was undertaken. The nine-item AO instrument's Cronbach's alpha was 0.919, thereby exceeding the previously defined requirement ($\alpha \geq 0.70$). Table 4.12 shows how Cronbach's alpha would change if any of the nine items were deleted.

Table 4.12 AO Total Statistics

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
We actively monitor our environment to identify partnering opportunities	30.51	32.817	0.570	0.578	0.919
We routinely gather information about prospective partners from various forums (e.g. trade shows, industry conventions, databases, publications, internet, etc.)	30.54	32.302	0.595	0.697	0.918
We are alert to market developments that create potential alliance opportunities	30.63	33.030	0.595	0.556	0.918
Our activities across different alliances are well coordinated	31.16	29.549	0.813	0.783	0.903
We systematically coordinate our strategies across different alliances	31.15	29.592	0.782	0.765	0.905
We have processes to systematically transfer knowledge across alliance partners	31.39	29.139	0.782	0.668	0.905
We conduct periodic reviews of our alliances to understand what we are doing right and what we are doing wrong	31.20	29.651	0.765	0.711	0.907
We periodically collect and analyze field experiences from our alliances	31.25	30.012	0.732	0.684	0.909
We modify our alliance related procedures as we learn from experience	31.04	29.934	0.778	0.740	0.906

As outlined prior to undertaking the reliability analysis (3.5 Data Analyses), the criterion of a Cronbach's alpha coefficient of 0.70 or higher for the AO instrument was achieved ($\alpha = 0.919$).

4.4.2.2 AO factor analysis

Factor analysis was conducted in order to test the dimensionality of the AO construct. The result of the factor analysis suggested that there were two factors. The first factor was dominant as it accounted for 60.9 percent of the variance, while the second factor accounted for 14.6 percent of the variance (Figure 4.2). The principal component analysis (Table 4.13) showed all item-loading to the first component was above, or equal to, 0.646. The loading on the second component was sporadic, showing no clear pattern.

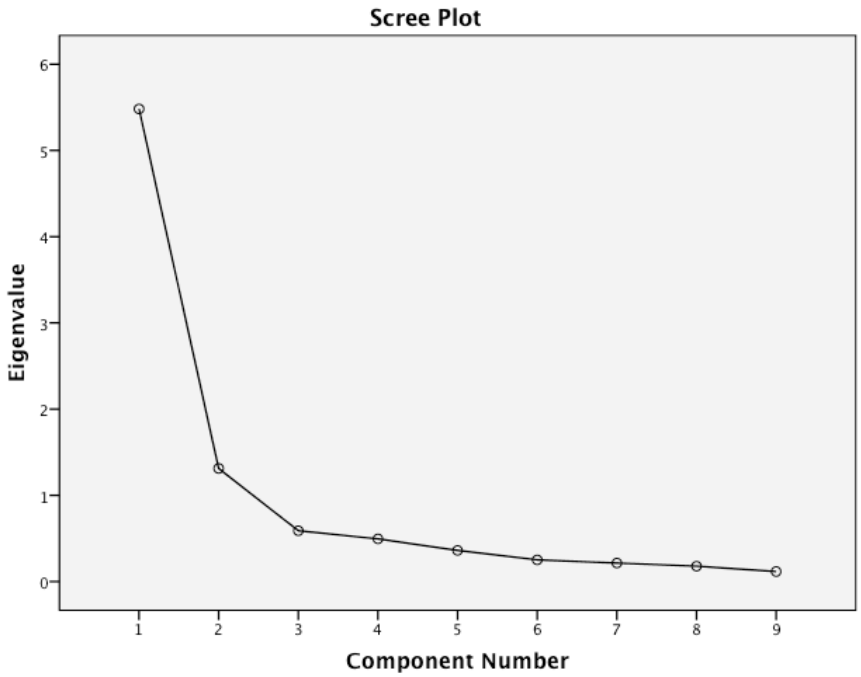


Figure 4.2 Alliance Orientation Scree Plot

Table 4.13 Alliance Orientation Component Matrix[a]

	Component	
	1	2
Our activities across different alliances are well coordinated	0.864	
We systematically coordinate our strategies across different alliances	0.841	
We have processes to systematically transfer knowledge across alliance partners	0.839	
We modify our alliance related procedures as we learn from experience	0.834	-0.332
We conduct periodic reviews of our alliances to understand what we are doing right and what we are doing wrong	0.825	-0.353
We periodically collect and analyze field experiences from our alliances	0.797	-0.331
We routinely gather information about prospective partners from various forums (e.g. trade shows, industry conventions, databases, publications, internet, etc.)	0.670	0.635
We are alert to market developments that create potential alliance opportunities	0.668	0.500
We actively monitor our environment to identify partnering opportunities	0.646	0.515

Extraction Method: Principal Component Analysis
a. 2 components extracted

4.4.2.3 AO instrument conclusion

Based on Kandermir, Yaprak, and Cavusgil's (2006) theoretical conceptualization of AO and the results of the reliability and factor analysis, an unweighted average of AO's nine items was used as a composite index score to represent the construct in subsequent analyses.

4.4.3 Business Performance

4.4.3.1 PERF reliability

In order to evaluate the internal reliability of the PERF instrument, a reliability analysis was undertaken. The eight-item PERF instrument's Cronbach's alpha was 0.844, thereby exceeding the previously defined requirement ($\alpha \geq 0.70$). Table 4.14 shows how Cronbach's alpha would change if any of the eight items were deleted.

Table 4.14 Business Performance Total Statistics

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
Generation of new innovative products or projects	26.06	31.325	0.661	0.545	0.818
New patents	26.61	28.030	0.537	0.371	0.839
Quality and relevance of scientific output	26.08	32.468	0.637	0.625	0.824
Attainment of scientific results or milestones	26.17	30.905	0.714	0.730	0.813
Recruitment of new personnel with outstanding knowledge and skills	26.43	31.485	0.518	0.350	0.833
Scientific or technological leadership in your environment	26.21	31.588	0.675	0.536	0.818
Attainment of new capital, either public or private	26.96	29.248	0.493	0.338	0.843
Maintenance and generation of alliances or partnerships	26.66	29.384	0.624	0.441	0.819

4.4.3.2 PERF factor analysis

Factor analysis was conducted in order to test the dimensionality of the PERF construct. The results showed that only one factor had a eigenvalue greater than one, indicating unidimensionality (Figure 4.3). Table 4.15 shows how each individual item loaded on a single factor.

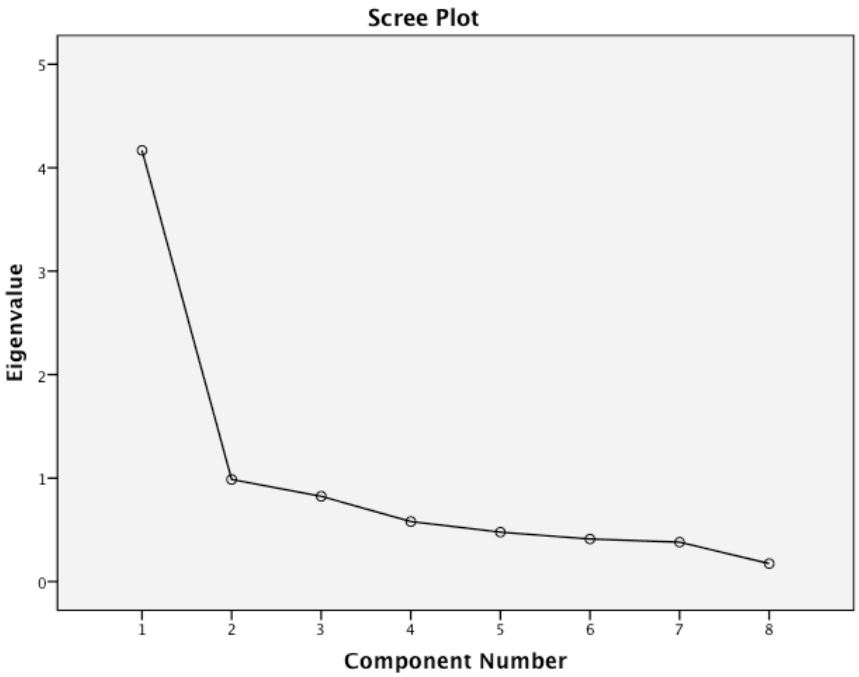


Figure 4.3 Business Performance Scree Plot

Table 4.15 Business Performance Component Matrix[a]

	Component
	1
Generation of new innovative products or projects	0.775
New patents	0.646
Quality and relevance of scientific output	0.763
Attainment of scientific results or milestones	0.841
Recruitment of new personnel with outstanding knowledge and skills	0.651
Scientific or technological leadership in your environment	0.774
Attainment of new capital, either public or private	0.578
Maintenance and generation of alliances or partnerships	0.709

Extraction Method: Principal Component Analysis
a. 1 components extracted

4.4.3.3 PERF instrument conclusion

Based on results of the reliability and factor analysis, an unweighted average of PERF's eight items was used as a composite index score to represent the construct in subsequent analyses.

4.5 Non-response Bias

Questionnaires that were received up to and including the week of the second mailing (June 25, 2012) were deemed early responses, while all others received after that week were regarded as late responses. Of the 81 usable responses, 58 were classified as early and 23 were classified as late responses.

Leveraging the works of Armstrong and Overton (1977), independent sample t-tests were conducted to compare the group of companies classified as early responders and the group of companies classified as late responders, based on their group mean scores of MO, AO, and PERF. There were no differences among the groups' MO ($t(79) = 0.233$, $p = 0.816$), AO ($t(78) = -0.840$, $p = 0.404$), or PERF ($t(77) = -0.611$, $p = 0.543$) scores.

4.6 Discriminant Validity

Discriminant validity between MO and AO was tested using group mean scores. Table 4.16 shows the correlations between MO and AO's group mean scores.

Table 4.16 Correlations[b]

		MO	AO
MO	Pearson Correlation Sig. (2-tailed)	1	
AO	Pearson Correlation Sig. (2-tailed)	0.469 0.000	1

b. Listwise N=80

The correlation coefficient between MO and AO was 0.469, the standard error was 0.098, and the 90 percent confidence interval was $0.296 \leq r \leq 0.622$. This confidence interval did not contain the number one, suggesting that acceptable discriminant validity between the group means was achieved (Kline 2005).

4.7 Descriptive Analyses

The subsequent sections use the descriptive items (response language, method of completion, science park location, association memberships, ownership structure, CEO's education, company age, and company size) as independent variables and the three main constructs (MO, AO, and PERF) as dependent variables in additional analyses.

4.7.1 Response Language

Independent sample t-tests were conducted to compare the group of companies that completed the questionnaires in English and the group of companies that completed questionnaires in French, based on their group mean scores of MO, AO, and PERF. There was a statistically significant difference ($t(77) = -2.788$, $p = 0.010$) between the English-speaking group's (3.684 ± 0.790) and the French-speaking group's (4.173 ± 0.527) PERF scores. However, there were no statistically significant differences among the groups' MO ($t(79) = -0.353$, $p = 0.725$) and AO ($t(78) = -1.420$, $p = 0.160$) scores.

4.7.2 Method of Completion

Independent sample t-tests were conducted to compare the group of companies that responded by mail and the group of companies that responded online, based on their group mean scores of MO, AO, and PERF. There were no statistically significant differences among the groups' MO ($t(79) = 0.484$, $p = 0.630$), AO ($t(78) = 0.090$, $p = 0.929$), and PERF ($t(77) = 0.349$, $p = 0.728$) scores.

4.7.3 Science Park Location

Independent sample t-tests were conducted to compare the group of companies located in science parks and the group of companies located outside of science parks, based on their group mean scores of MO, AO, and PERF. There were no statistically significant differences among the groups' MO ($t(78) = -0.779$, $p = 0.439$), AO ($t(78) = -1.083$, $p = 0.282$), and PERF ($t(77) = 0.001$, $p = 0.999$) scores.

4.7.4 Association Memberships

Three linear regression analyses were performed using the number of association memberships as the independent variable and MO, AO, and PERF alternating as the dependent variable. The results of the regression models indicated that the number of association memberships had no statistically significant effects on MO ($R^2 = 0.023$, $F(1, 79) = 1.896$, $p = 0.172$), AO ($R^2 = 0.036$, $F(1, 78) = 2.901$, $p = 0.093$), and PERF ($R^2 = 0.017$, $F(1, 77) = 1.314$, $p = 0.255$).

4.7.5 Ownership Structure

Originally, ownership structures were categorized into four groups (Table 4.3). However, due to the small number of responses in two categories (subsidiary and non-profit), they were omitted, leaving two ownership groups. The remaining ownership groups were privately owned and publicly traded.

Independent sample t-tests were conducted to compare the group of companies that were privately owned and the group of companies that were publicly traded, based on their group mean scores of MO, AO, and PERF. There was a statistically significant difference ($t(72) = 2.687$, $p = 0.009$) between the privately owned group's (3.928 ± 0.674) and the publicly traded group's (3.353 ± 0.824) MO scores. However, there were no statistically significant differences among the groups' AO ($t(72) = -0.098$, $p = 0.922$) and PERF ($t(71) = 0.224$, $p = 0.823$) scores.

4.7.6 Educational Background

Originally, educational backgrounds of CEOs were categorized into eight groups (Table 4.4). Due to the small number of responses in several categories (e.g. engineering and arts), educational background categories were collapsed into five groups, namely doctoral, business, medical/science, hybrid, and other.

ANOVAs were conducted to compare groups of companies with CEOs that had varying educational background, based on their group mean scores of MO, AO, and PERF. There were no statistically significant differences among the groups' MO ($F(4, 76) = 0.303$, $p = 0.516$), AO ($F(4,75) = 0.505$, $p = 0.732$), and PERF ($F(4,74) = 0.212$, $p = 0.931$) scores.

4.7.7 Company Age

Three linear regression analyses were performed using the age of companies as the independent variable and MO, AO, and PERF alternating as the dependent variable. The results of the first two regression models indicated that the age of companies had no statistically significant effects on MO ($R^2 = 0.001$, $F(1, 78) = 0.099$, $p = 0.754$) and AO ($R^2 = 0.069$, $F(1, 78) = 0.378$, $p = 0.541$). However, the third regression model indicated that the age of companies had a negative and statistically significant effect on PERF ($R^2 = 0.321$, $F(1, 77) = 8.842$, $p = 0.004$).

4.7.8 Company Size

Originally, companies were classified as micro, small, medium, and large (Table 4.6). Due to the small number of responses in the medium and large categories, only companies in the micro and small categories were compared.

Independent sample t-tests were conducted to compare the group of companies that were categorized as micro and the group of companies that were categorized as small, based on their group mean scores of MO, AO, and PERF. There were no statistically significant differences

among the groups' MO ($t(70) = -0.992$, $p = 0.325$), AO ($t(70) = -0.867$, $p = 0.389$), and PERF ($t(69) = 0.211$, $p = 0.834$) scores.

4.7.9 Descriptive Analyses Conclusion

The preceding analyses yielded few statistically significant results. Therefore, descriptive characteristics were not included in the subsequent regression analyses.

4.8 Regression Analyses

For each respondent, the 12 MO items were unweighted and averaged, the nine AO items were unweighted and averaged, and the eight PERF items were unweighted and averaged, creating MO, AO, and PERF composite index scores. In the subsequent sections, these composite index scores were used in regression analyses.

4.8.1 Market Orientation and Business Performance

Linear regression was performed using MO as the independent variable and PERF as the dependent variable.

$$PERF = \beta(MO) + C$$

In order to treat missing data, listwise deletion was employed. Tables 4.17, 4.18, and 4.19 show the results from the regression analysis.

Table 4.17 H1 Model Summary

Model	R	R^2	Adj. R^2	Std. Error of the Estimate
1	0.303[a]	0.092	0.080	0.74063

a. Predictors: (Constant), MO

Table 4.18 H1 ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	4.273	1	4.273	7.790	0.007[b]
Residual	42.237	77	0.549		
Total	46.510	78			

a. Dependent Variable: PERF
b. Predictors: (Constant), MO

Table 4.19 H1 Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.514	0.455		5.521	0.000
MO	0.329	0.118	0.303	2.791	0.007

a. Dependent Variable: PERF

The result of this regression model indicated that MO had a positive and statistically significant effect ($\beta = 0.329$, $p = 0.007$) on PERF ($R^2 = 0.092$, $F(1, 77) = 7.790$, $p = 0.007$). The regression model was as follows:

$$PERF = 0.329(MO) + 2.514$$

According to G*Power's (1996) post hoc power analysis, with an effect size of $f^2 = 0.101$, an error probability of $\alpha = 0.05$, one predictor variable (MO), and a total sample size of 79, achieved power ($1-\beta$) was 0.80, meeting the minimum power requirement ($1-\beta = 0.80$) as suggested by Cohen (1988).

4.8.2 Alliance Orientation and Performance

Linear regression was performed using AO as the independent variable and PERF as the dependent variable.

$$PERF = \beta(AO) + C$$

In order to treat missing data, listwise deletion was employed. Tables 4.20, 4.21, and 4.22 show the results from the regression analysis.

Table 4.20 H2 Model Summary

Model	R	R^2	Adj. R^2	Std. Error of the Estimate
1	0.668[a]	0.446	0.439	0.57835

a. Predictors: (Constant), AO

Table 4.21 H2 ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	20.754	1	20.754	62.046	0.000[b]
Residual	25.756	77	0.334		
Total	46.510	78			

a. Dependent Variable: PERF
b. Predictors: (Constant), AO

Table 4.22 H2 Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	0.902	0.369		2.442	0.017
AO	0.737	0.094	0.668	7.877	0.000

a. Dependent Variable: PERF

The result of this regression model indicated that AO had a positive and statistically significant effect ($\beta = 0.737$, $p < 0.001$) on PERF ($R^2 = 0.446$, $F(1, 77) = 62.046$, $p < 0.001$). The regression model was as follows:

$$PERF = 0.737(AO) + 0.902$$

According to G*Power's (1996) post hoc power analysis, with an effect size of $f^2 = 0.805$, an error probability of $\alpha = 0.05$, one predictor variable (AO), and a total sample size of 79, achieved power (1-β) was 1.00, exceeding the minimum power requirement (1-β = 0.80) as suggested by Cohen (1988).

4.8.3 Market Orientation, Alliance Orientation, and Business Performance

Linear regression was performed using MO and AO as the independent variables and PERF as the dependent variable.

$$PERF = \beta_1(MO) + \beta_2(AO) + C$$

In order to treat missing data, listwise deletion was employed. Tables 4.23, 4.24, and 4.25 show the results from the regression analysis.

Table 4.23 H3 Model Summary

Model	R	R^2	Adj. R^2	Std. Error of the Estimate
1	0.668[a]	0.446	0.432	0.58207

a. Predictors: (Constant), AO, MO

Table 4.24 H3 ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	20.761	2	10.380	30.638	0.000[b]
Residual	25.749	76	0.339		
Total	46.510	78			

a. Dependent Variable: PERF
b. Predictors: (Constant), AO, MO

Table 4.25 H3 Coefficients [a]

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	0.930	0.424		2.195	0.031
MO	-0.015	0.105	-0.014	-0.141	0.888
AO	0.744	0.107	0.674	6.976	0.000

a. Dependent Variable: PERF

The result of this regression model indicated that AO had a positive and statistically significant effect ($\beta_2 = 0.744$, $p < 0.001$) on PERF and MO had a non-significant effect ($\beta_1 = -0.015$, $p = 0.888$) on PERF ($R^2 = 0.446$, $F(2, 76) = 30.638$, $p < 0.001$). The regression model was as follows:

$$PERF = -0.015(MO) + 0.744(AO) + 0.930$$

According to G*Power's (1996) post hoc power analysis, with an effect size of $f^2 = 0.805$, an error probability of $\alpha = 0.05$, two predictor variables (MO and AO), and a total sample size of 79 achieved power ($1-\beta$) was 1.00, exceeding the minimum power requirement ($1-\beta = 0.80$) as suggested by Cohen (1988).

4.8.4 Market Orientation and Alliance Orientation

Linear regression was performed using MO as the independent variable and AO as the dependent variable.

$$AO = \beta(MO) + C$$

In order to treat missing data, listwise deletion was employed. Tables 4.26, 4.27, and 4.28 show the results from the regression analysis.

Table 4.26 Mediation Model Summary

Model	R	R^2	Adj. R^2	Std. Error of the Estimate
1	0.469[a]	0.220	0.210	0.61856

a. Predictors: (Constant), MO

Table 4.27 Mediation ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	8.415	1	8.415	21.992	0.000[b]
Residual	29.844	78	0.383		
Total	38.259	79			

a. Dependent Variable: AO
b. Predictors: (Constant), MO

Table 4.28 Mediation Coefficients [a]

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.139	0.379		5.642	0.000
MO	0.459	0.098	0.469	4.690	0.000

a. Dependent Variable: AO

The result of this regression model indicated that MO had a positive and statistically significant effect ($\beta = 0.459$, $p < 0.001$) on AO ($R^2 = 0.220$, $F(1, 78) = 21.992$, $p < 0.001$). The regression model was as follows:

$$AO = 0.459(MO) + 2.139$$

According to G*Power's (1996) post hoc power analysis, with an effect size of $f^2 = 0.282$, an error probability of $\alpha = 0.05$, one predictor variable (MO), and a total sample size of 80 achieved power ($1-\beta$) was 1.00, exceeding the minimum power requirement ($1-\beta = 0.80$) as suggested by Cohen (1988).

4.9 Post-Hoc Analyses

4.9.1 Market Orientation and Business Performance

An additional linear regression was performed to examine MO's effect on PERF, with control variables added. These control variables included whether a company was located in a science park (SP), the number of association memberships held by a company (AM), the ownership structure, age of companies (AGE), and the number of employees (SIZE). Because the company ownership structure is a categorical variable with five options (e.g. privately owned, publicly traded, subsidiary, non-profit, and other), three dummy variables (n-1) were created and included in the regression model. These three dummy variables consider whether a company was privately owned (PO), publicly traded (PT), or a subsidiary (SUB). In order to treat missing data, listwise deletion was employed. Tables 4.29, 4.30, and 4.31 show the results from the regression analysis.

Table 4.29 Post-Hoc H1 Model Summary

Model	R	R^2	Adj. R^2	Std. Error of the Estimate
1	0.515[a]	0.265	0.180	0.68903

a. Predictors: (Constant), MO, SP, AM, PO, PT, SUB, AGE, SIZE

Table 4.30 Post-Hoc H1 ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	11.797	8	1.475	3.106	0.005[b]
Residual	32.759	69	0.475		
Total	44.555	77			

a. Dependent Variable: PERF
b. Predictors: (Constant), MO, SP, AM, PO, PT, SUB, AGE, SIZE

Table 4.31 Post-Hoc H1 Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.608	0.664		3.927	0.000
MO	0.349	0.119	0.328	2.926	0.005
SP	-0.043	0.178	-0.027	-0.240	0.811
AM	0.034	0.062	0.062	0.545	0.587
PO	0.135	0.500	0.077	0.270	0.788
PT	0.242	0.526	0.119	0.549	0.647
SUB	-0.360	0.609	-0.105	-0.592	0.556
AGE	0.023	0.008	-0.313	-2.944	0.004
SIZE	0.000	0.000	-0.126	-1.178	0.243

a. Dependent Variable: PERF

Controlling for SP, AM, PO, PT, SUB, AGE, and SIZE, MO had a positive and statistically significant effect ($\beta_1 = 0.349$, $p = 0.005$) on PERF ($R^2 = 0.265$, $F(8, 69) = 3.106$, $p = 0.005$). According to G*Power's (1996) post hoc power analysis, with an effect size of $f^2 = 0.361$, an error probability of $\alpha = 0.05$, eight predictor variables (MO, SP, AM, PO, PT, SUB, AGE, SIZE), and a total sample size of 77, achieved power ($1-\beta$) was 1.00, exceeding the minimum power requirement ($1-\beta = 0.80$) as suggested by Cohen (1988).

4.9.2 Alliance Orientation and Business Performance

An additional linear regression was performed to examine AO's effect on PERF, with the aforementioned control variables added. In order to treat missing data, listwise deletion was employed. Tables 4.32, 4.33, and 4.34 show the results from the regression analysis.

Table 4.32 Post-Hoc H2 Model Summary

Model	R	R^2	Adj. R^2	Std. Error of the Estimate
1	0.762[a]	0.581	0.532	0.52014

a. Predictors: (Constant), AO, SP, AM, PO, PT, SUB, AGE, SIZE

Table 4.33 Post-Hoc H2 ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	25.888	8	3.236	11.961	0.000[b]
Residual	18.667	69	0.271		
Total	44.555	77			

a. Dependent Variable: PERF

b. Predictors: (Constant), AO, SP, AM, PO, PT, SUB, AGE, SIZE

Table 4.34 Post-Hoc H2 Coefficients [a]

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.734	0.544		1.349	0.182
AO	0.752	0.092	0.696	8.192	0.000
SP	0.109	0.136	0.068	0.800	0.426
AM	0.006	0.046	0.011	0.131	0.896
PO	0.383	0.377	0.218	1.016	0.313
PT	0.265	0.396	0.131	0.668	0.506
SUB	0.473	0.471	0.138	1.005	0.318
AGE	-0.020	0.006	-0.269	-3.358	0.001
SIZE	0.000	0.000	-0.121	-1.510	0.136

a. Dependent Variable: PERF

Controlling for SP, AM, PO, PT, SUB, AGE, and SIZE, AO had a positive and statistically significant effect ($\beta_1 = 0.752$, $p < 0.001$) on PERF ($R^2 = 0.581$, $F(8, 69) = 11.961$, $p < 0.001$). According to G*Power's (1996) post hoc power analysis, with an effect size of $f^2 = 1.387$, an error probability of $\alpha = 0.05$, eight predictor variables (MO, SP, AM, PO, PT, SUB,

AGE, SIZE), and a total sample size of 77, achieved power (1-β) was 1.00, exceeding the minimum power requirement (1-β = 0.80) as suggested by Cohen (1988).

4.9.3 Market Orientation, Alliance Orientation, and Business Performance

An additional linear regression was performed to examine MO and AO's effects on PERF, with the aforementioned control variables added. In order to treat missing data, listwise deletion was employed. Tables 4.35, 4.36, and 4.37 show the results from the regression analysis.

Table 4.35 Post-Hoc H3 Model Summary

Model	R	R^2	Adj. R^2	Std. Error of the Estimate
1	0.762[a]	0.581	0.526	0.52395

a. Predictors: (Constant), MO, AO, SP, AM, PO, PT, SUB, AGE, SIZE

Table 4.36 Post-Hoc H3 ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	25.889	9	2.876	10.478	0.000[b]
Residual	18.667	68	0.275		
Total	44.555	77			

a. Dependent Variable: PERF

b. Predictors: (Constant), MO, AO, SP, AM, PO, PT, SUB, AGE, SIZE

Table 4.37 Post-Hoc H3 Coefficients [a]

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	0.732	0.569		1.286	0.203
MO	0.001	0.103	0.001	0.013	0.990
AO	0.751	0.105	0.695	7.164	0.000
SP	0.109	0.137	0.068	0.794	0.430
AM	0.006	0.047	0.011	0.126	0.900
PO	0.383	0.382	0.218	1.003	0.319
PT	0.265	0.400	0.131	0.663	0.510
SUB	0.473	0.477	0.138	0.991	0.325
AGE	-0.020	0.006	-0.269	-3.320	0.001
SIZE	0.000	0.000	-0.121	-1.498	0.139

a. Dependent Variable: PERF

Controlling for SP, AM, PO, PT, SUB, AGE, and SIZE, AO had a positive and statistically significant effect ($\beta_2 = 0.751$, $p < 0.001$) on PERF and MO had a non-significant effect ($\beta_1 = 0.001$, $p = 0.990$) on PERF ($R^2 = 0.581$, $F(9, 68) = 10.478$, $p < 0.001$). According to G*Power's (1996) post hoc power analysis, with an effect size of $f^2 = 1.387$, an error probability of $\alpha = 0.05$, nine predictor variables (MO, AO, SP, AM, PO, PT, SUB, AGE, SIZE), and a total sample size of 77, achieved power ($1-\beta$) was 1.00, exceeding the minimum power requirement ($1-\beta = 0.80$) as suggested by Cohen (1988).

4.9.4 Market Orientation and Alliance Orientation

An additional linear regression was performed to examine MO's effect on PERF, with the aforementioned control variables added. In order to treat missing data, listwise deletion was employed. Tables 4.38, 4.39, and 4.40 show the results from the regression analysis.

Table 4.38 Post-Hoc Mediation Model Summary

Model	R	R^2	Adj. R^2	Std. Error of the Estimate
1	0.588[a]	0.346	0.271	0.59755

a. Predictors: (Constant), MO, SP, AM, PO, PT, SUB, AGE, SIZE

Table 4.39 Post-Hoc Mediation ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	13.214	8	1.652	4.626	0.000[b]
Residual	24.995	70	0.357		
Total	38.208	78			

a. Dependent Variable: AO

b. Predictors: (Constant), MO, SP, AM, PO, PT, SUB, AGE, SIZE

Table 4.40 Post-Hoc Mediation Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	2.505	0.574		4.363	0.000
MO	0.461	0.103	0.471	4.489	0.000
SP	-0.205	0.152	-0.140	-1.351	0.181
AM	0.037	0.054	0.074	0.695	0.489
PO	-0.332	0.433	-0.204	-0.767	0.446
PT	-0.032	0.456	-0.017	-0.070	0.944
SUB	-1.111	0.528	-0.350	-2.105	0.039
AGE	-0.004	0.007	-0.062	-0.624	0.535
SIZE	0.000	0.000	-0.005	-0.053	0.958

a. Dependent Variable: AO

Controlling for SP, AM, PO, PT, SUB, AGE, and SIZE, MO had a positive and statistically significant effect ($\beta_1 = 0.461$, $p < 0.001$) on AO ($R^2 = 0.346$, $F(8, 70) = 4.626$, $p < 0.001$). According to G*Power's (1996) post hoc power analysis, with an effect size of $f^2 = 0.529$, an error probability of $\alpha = 0.05$, eight predictor variables (MO, SP, AM, PO, PT, SUB, AGE, SIZE), and a total sample size of 78 achieved power ($1-\beta$) was 1.00, exceeding the minimum power requirement ($1-\beta = 0.80$) as suggested by Cohen (1988).

CHAPTER 5
DISCUSSION

5.1 Responses

The number of responses received was greater than, or similar to, other studies examining MO in the biotechnology industry (Appiah-Adu and Ranchhod 1998; De Luca, Verona, and Vicari 2010; Renko, Carsrud, and Brannback 2009). Appiah-Adu and Ranchhod (1998) received 62 usable responses in their study of UK biotechnology companies, De Luca, Verona, and Vicari (2010) received 70 usable responses from Italian biotechnology companies, and Renko, Carsrud, and Brannback (2009) received 85 responses when researching the biotechnology industry in the US and Scandinavia. Comparatively, the number of responses received was favourable to similar studies of MO in the biotechnology industry.

5.2 Demographics

Dillman (1978) suggests that obtaining a local endorsement can increase the number of responses in a study (Dillman 1978). The collaboration with UQAM allowed for questionnaires to be translated from English into French. Additionally, the endorsement from the university may have helped legitimize the study among the French-speaking business community. Dillman (2000) suggests that the number of responses can be increased by employing a multi-modal approach (e.g. mail and online) (Dillman 2000). This study's online completion option aided in generating 20 additional responses, supporting Dillman's (2000) recommendations.

Table 4.1 shows the number and percentage of companies located in each province and the number and percentage of responses from each province. The percentages of responses from British Columbia, Alberta, Saskatchewan, Prince Edward Island, and Nova Scotia were greater than the percentages of companies located in the provinces. The percentages of responses from Manitoba, Ontario, Quebec, and Newfoundland and Labrador were less than the percentages of

companies located in the provinces. However, only Alberta, Ontario, and Quebec's differences exceeded five percent. Overall, the percentage of responses from each province closely resembled the percentage of companies located in each province.

The number of biotechnology industry associations is increasing as they are playing an important role in advancing innovation (Bagchi-Sen, Smith, and Hall 2004). Furthermore, biotechnology industry associations are said to be central to the biopartnering process, as they encourage companies to form partnerships and collaborate to mutually benefit (Baum, Calabrese, and Silverman 2000). In the US, most states have at least one biotechnology association (Bagchi-Sen, Smith, and Hall 2004). Similarly, in Canada, there are national, regional, and provincial biotechnology associations (BIOTECanada 2011c; Life Sciences Association of Manitoba 2012). Seventy-nine percent of the respondents from this study held at least one biotechnology association membership, reiterating their perceived importance.

Most biotechnology companies in Canada are SMEs (Conference Board of Canada 2005; Datamonitor 2011b; Rajamaki 2008; Government of Canada 2012; BIOTECanada 2011b). Using Industry Canada's (2011) employment size categories, the majority of responses from this study were from micro (16%) or small (71.6%) companies. Therefore, the number of responses from SMEs were consistent with industry statistics and reflective of the population.

5.3 Reliability

All of the instruments' Cronbach's alpha coefficients exceeded the previously defined requirement ($\alpha \geq 0.70$). The MO instrument's Cronbach's alpha coefficient was 0.876, a good internal reliability coefficient as described by George and Mallery (2009). It was expected that a lower Cronbach's alpha coefficient would be obtained because Narver and Slater's (1990) MO instrument had not been used in the Canadian medical/healthcare subsector of the biotechnology industry. However, the internal reliability coefficient obtained from the MO instrument

exceeded expectations. The favourable Cronbach's alpha coefficient signified that all of the items were correlated with each other and measured the same phenomenon (e.g. MO) (SAGE Research Methods 2012b). This could be the result of the instrument's extensive use and the advanced practices of MO research.

The Kandemir, Yaprak, and Cavusgil (2006) AO instrument was developed to measure the acquisition, interpretation, and use of alliance management knowledge in the US technology industry, where the presence of strategic alliances among technology companies are increasing and of growing importance (Hagedoorn and Duysters 2002; Gulati 1998; Verspagen and Duysters 2004). The AO instrument's Cronbach's alpha coefficient was 0.919, an excellent internal reliability coefficient as described by George and Mallery (2009). It was expected that a lower Cronbach's alpha coefficient would be obtained because of the limited research utilizing the AO instrument. However, the internal reliability coefficient obtained from the AO instrument exceeded expectations, signifying that all of the items were correlated with each other and measured the same phenomenon (e.g. AO). This may have been due to the similarities between this empirical setting (e.g. biotechnology industry) and the empirical setting for which the instrument was developed (e.g. technology industry). Specifically, the technology industry is similar to the biotechnology industry as organizational success has been shown to rely on effective strategic alliance management (Baum, Calabrese, and Silverman 2000; Baum and Silverman 2004; Forest and Martin 1992; George et al. 2001; Sarkar, Echambadi, and Harrison 2001).

The PERF instrument's Cronbach's alpha coefficient was 0.844, a good reliability coefficient as described by George and Mallery (2009). It was expected that a lower Cronbach's alpha coefficient would be obtained because the PERF instrument, created by adapting and

broadening the De Luca, Verona, and Vicari (2010) R&D effectiveness instrument, had never been empirically tested prior to this study. Obtaining a Cronbach's alpha coefficient of 0.70 is generally accepted and justified when instruments are new and used in exploratory work (Nunnally 1978). The internal reliability coefficient obtained from the PERF instrument exceeded expectations, signifying that all of the items were correlated with each other and measured the same phenomenon (e.g. PERF). Adapting and broadening the R&D effectiveness instrument to include items related to capital, alliances and partnerships, and milestones may have been the reason for its success in this study.

5.4 Non-response Bias

Analyses were performed (4.5 Non-response Bias) in order to determine the presence, or absence, of a non-response bias. No statistically significant differences were found in the analyses, suggesting that early and late responders did not differ. Statistically, as early and late responders did not significantly differ, there was no evidence that supported the existence of a non-response bias (Armstrong and Overton 1977).

5.5 Descriptive Analyses

5.5.1 Response Language

The results from the independent sample t-tests, that compared the group of companies that completed the questionnaires in English and the group of companies that completed the questionnaires in French, showed no statistically significant differences among the groups' MO or AO scores (4.7.1 Response Language). There was a statistically significant difference between the English-speaking group's and the French-speaking group's PERF scores. Statistically, the mean PERF score of French-speaking companies was significantly higher than the English-speaking companies MO score, suggesting that French-speaking companies outperformed English-speaking companies.

Practically, there are two possible explanations for the statistically significant finding. The first explanation for the statistically significant finding is that French-speaking companies slightly outperformed English-speaking companies. A second explanation for the statistically significant finding is that French-speaking companies have a slightly higher perceived valuation of performance than English-speaking companies.

5.5.2 Method of Completion

Kwak and Radler (2002) found that respondents differed based on data collection formats. The results from the independent sample t-tests, that compared the group of companies that responded by mail and the group of companies that responded online, showed no statistically significant differences among the groups' MO, AO, or PERF scores (4.7.2 Method of Completion). This refutes Kwak and Radler's (2002) findings, suggesting that respondents did not differ based on data collection formats. An explanation for this may be that all respondents in the biotechnology industry are technologically-oriented, and the method of completion is not a measure of their organization's performance record nor its orientation to the market and alliances.

5.5.3 Science Park Location

It has been shown that positive externalities and other economic benefits can occur when similar companies geographically cluster around, and knowledge share with, one another (Folta, Cooper, and Baik 2006; Efendioglu 2005). However, Folta, Cooper, and Baik (2009) found that large biotechnology clusters can actually inhibit positive economic benefits and even cause negative externalities for companies.

The results from the independent sample t-tests, that compared the group of companies located in science parks and the group of companies located outside of science parks, showed no differences among the groups' MO, AO, or PERF scores (4.7.3 Science Park Location). This

suggests that geographical clustering does not increase or decrease Canadian medical/healthcare biotechnology companies' MO, AO, or PERF.

One explanation for the non-significant differences is that companies with close geographical proximity may not actually be participating in knowledge-sharing. Moreover, it is possible that the importance of geographical clustering could be overstated, resulting in the interpretation that clustering positively influences performance. Secondly, companies that are geographically clustered may have dissimilar focuses, resulting in little or no knowledge-sharing. Another explanation is that, due to the peculiarities of the Canadian medical/healthcare subsector of the biotechnology industry, clustering is not as important as being market-oriented or alliance-oriented.

5.5.4 Association Memberships

Association memberships have been shown to advance innovation in the biotechnology industry (Bagchi-Sen, Smith, and Hall 2004). Yet, according to Baum, Calabrese, and Silverman (2000), Canadian biotechnology companies that had numerous industry association memberships performed poorly. Baum, Calabrese, and Silverman (2000) suggested that companies that hold several association memberships do so to make up for founders' lack, or size, of professional networks.

The number of association memberships were used as the independent variable and MO, AO, and PERF were used as the dependent variable in regression analyses. Results indicated that the number of association memberships did not affect MO, AO, or PERF (4.7.4 Association Memberships). The number of industry association memberships that medical/healthcare biotechnology companies have does not appear to influence its MO, AO, or PREF scores. This refutes Baum, Calabrese, and Silverman's (2000) findings that suggest association memberships dampen performance. One reason for this incongruence could be that industry association

memberships matter more in the medical/healthcare subsector as opposed to the entire Canadian biotechnology industry, as they did not lower performance. Secondly, it could be related to the timing of the two studies, as they were conducted over 10 years apart. Finally, it could be related to the process of obtaining an association membership, as most associations only require its members to pay an annual fee (Newfoundland and Labrador Association of Technology Industries 2013; Life Sciences British Columbia 2012; BioNova 2013; BioAlberta 2013; BIOTECanada 2013; Ag-West Bio 2013). Furthermore, many biotechnology associations allow non-biotechnology companies (e.g. accounting firms) to hold memberships (Newfoundland and Labrador Association of Technology Industries 2013; Life Sciences British Columbia 2012; BioNova 2013; BioAlberta 2013; BIOTECanada 2013; Ag-West Bio 2013). Overall, no evidence was found to suggest that industry association memberships increased or decreased MO, AO, or PERF.

5.5.5 Ownership Structure

The differences in biotechnology ownership types have been shown to influence companies' corporate strategies and performance (Baum, Calabrese, and Silverman 2000; Stuart, Hoang, and Hybels 1999; Zahra 1996). Zahra (1996) showed that independent biotechnology companies outperformed corporate-sponsored biotechnology companies. Stuart (1999) demonstrated how biotechnology companies with established partners issued stock and had higher initial valuations than companies without such partners.

The results from the independent sample t-tests that compared the group of companies that were privately owned and the group of companies that were publicly traded, showed no statistically significant differences among the groups' AO or PERF scores (4.7.5 Ownership Structure). This contrasts previous findings that suggest differing ownership types influence performance. Leveraging the results from this study's hypotheses to rationalize the ownership

structure findings, it can be said that a business' performance is influenced more by its behavioural commitments, organizational culture, and activities than its legal structure.

There was a statistically significant difference between the privately owned group's and the publicly traded group's MO scores. Statistically, the mean MO score of privately owned companies was significantly higher than the publicly traded mean MO score, suggesting that privately owned companies were more market-oriented. When a company becomes publicly traded it is accountable to new people, namely the shareholders. Perhaps this new accountability shifts some of the organizational focus from customers, competitors, and business units to shareholders, resulting in a decrease in MO. Although a statistically significant difference was found between the two MO scores, the MO score of publicly traded companies was not low. Therefore, privately owned and publicly traded Canadian medical/healthcare biotechnology companies are market-oriented, but by how much may be dependent on companies' stakeholders.

5.5.6 Educational Background

The importance of the educational background of biotechnology CEOs has been widely debated (Kermani and Gittins 2004; McMillan and Thomas 2005; Patzelt 2010). The education of biotechnology CEOs has been shown to influence a company's meaningfulness of patents, valuation at the time of initial public offering, and stock price (McMillan and Thomas 2005). Conversely, Patzelt (2010) found that in a cross-cultural study of European and US biotechnology companies, education of CEOs did not influence financial performance (Patzelt 2010).

ANOVAs were conducted to compare groups of companies with CEOs that had varying educational backgrounds, based on their group mean MO, AO, and PERF scores. No statistically significant differences were found among the groups' MO, AO, or PERF scores (4.7.6 Educational Background). The educational backgrounds of CEOs seemed to play no role in

determining companies' performance or orientation to the market and alliances. It is possible that Canadian medical/healthcare biotechnology CEOs who have specific skills, surround themselves with other individuals who have complementary knowledge and experience. It may be that this effective management of knowledge and experience enables all types of managers to perform optimally.

5.5.7 Company Age

A study of US biotechnology companies showed that the stock market favoured older and more established companies (McMillan and Thomas 2005). Conventional wisdom suggests that companies that successfully move through the organizational lifecycle, reach profitability and perform well, or at least well enough for continued existence.

The age of companies was used as the independent variable and MO, AO, and PERF were used as the dependent variable in regression analyses. Results indicated that the age of companies did not have statistically significant effects on MO or AO (4.7.7 Company Age). However, the age of companies had a statistically significant effect on PERF (4.7.7 Company Age). Specifically, the age of companies had a negative influence on PERF. Therefore, younger companies performed more favourably than older companies, refuting McMillan's (2005) findings. These results suggest younger companies perform well financially, securing private and public capital. Furthermore, younger companies are better able to secure patents, attain milestones, recruit new personnel, and demonstrate technological leadership as opposed to their older counterparts. This should be interpreted with caution, as this does not necessarily mean that older companies perform poorly, but perhaps there are more deliverables in the early years.

5.5.8 Company Size

In Woiceshyn and Hartel's (1996) study of Canadian biotechnology companies they found that sales performance increased with company size. The results from the independent

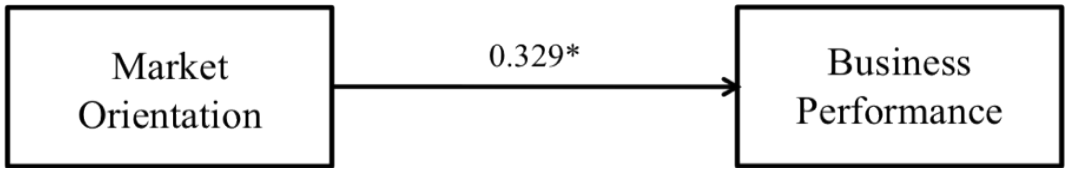
sample t-tests that compared the group of companies that were categorized as micro and the group of companies that were categorized as small, showed no statistically significant differences among the groups' MO, AO, or PERF scores (4.7.8 Company Size). This suggests that micro and small companies do not differ in terms of overall performance or their orientation to marketing and alliance management. It is important to note that due to insufficient data, this analysis only compared micro and small companies. Therefore, it cannot be said with certainty that company size does not influence performance, as performance may significantly differ if micro and large companies were compared.

5.6 Hypotheses

5.6.1 Hypothesis 1

Businesses with commitments to marketing and marketing strategy tend to outperform those without such commitments (Narver and Slater 1990). This notion has been discussed by managers and studied by academics for decades (Narver and Slater 1990). Narver and Slater's (1990) MO instrument, designed to measure commitment to marketing and marketing strategy, has been used in various industries and cultural contexts, repeatedly lending support for its positive effect on performance (Appiah-Adu and Ranchhod 1998; Narver and Slater 1990; Subramanian and Gopalakrishna 2001; Deng and Dart 1994). However, few empirical investigations explore MO and performance in the biotechnology industry (Appiah-Adu and Ranchhod 1998; De Luca, Verona, and Vicari 2010; Renko, Carsrud, and Brannback 2009). Furthermore, studies that have examined MO's effect on performance in the biotechnology industry have produced contradictory findings, suggesting that MO may be somewhat contingent on the cultural context (Appiah-Adu and Ranchhod 1998; De Luca, Verona, and Vicari 2010; Renko, Carsrud, and Brannback 2009).

The first hypothesis envisaged that MO has a positive and significant effect on business performance. Results showed that the independent variable MO had a positive and statistically significant effect on the dependent variable PERF (4.8.1 Market Orientation and Business Performance), thus supporting H1 (Figure 5.1).



* $p < 0.01$

Figure 5.1 Model 1

Highly market-oriented Canadian medical/healthcare biotechnology companies achieved greater performance scores as compared to their lower market-oriented counterparts. Companies that are committed to MO understand and create value for their target markets, recognize their competitors' strengths, weaknesses, capabilities, and strategies, and disseminate information and share resources with other business units (Narver and Slater 1990). The positive and statistically significant relationship between MO and PERF suggests that Canadian medical/healthcare biotechnology companies that understand their customers, acknowledge their competitors, and share knowledge with departments, outperform those that do not have such understandings or practices. More broadly, organizations that are highly market-oriented possess an organizational culture that encourages behavioural commitments to marketing and marketing strategy (Narver and Slater 1990). This commitment to marketing and marketing strategy among Canadian medical/healthcare companies leads to increased business performance.

Support for H1 is consistent with the growing body of research that suggests MO affects business performance. More specifically, it is congruent with the results from Appiah-Adu and

Ranchhod's (1998) study of UK biotechnology companies and Renko, Carsrud, and Brannback's (2009) findings related to Scandinavian human health biotechnology companies. Appiah-Adu and Ranchhod (1998) confirmed that UK biotechnology companies committed to MO outperformed their competitors in terms of market share, profit margins, and overall performance. Renko, Carsrud, and Brannback (2009) discussed how the relationship between MO and capital invested may be culturally dependent, as it was statistically significant among Scandinavian but not US human health biotechnology companies. Moreover, De Luca, Verona, and Vicari (2010) found that of the three MO components, only interfunctional coordination was positively correlated with Italian biotechnology companies' performance, providing further evidence that the strength of the MO and performance relationship may be culturally dependent.

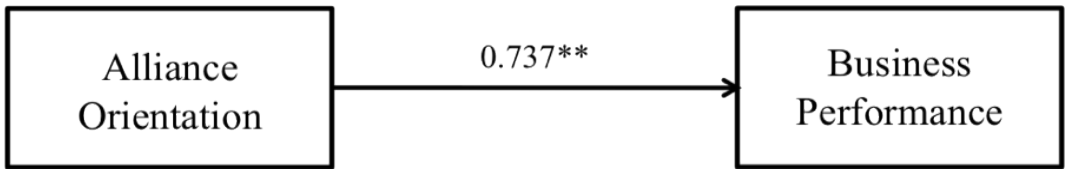
In summary, Canadian medical/healthcare biotechnology companies with high MO scores outperformed those with lower MO scores, providing support for the first hypothesis. However, a company's commitment to MO does not solely necessitate strong business performance, thus the result of H1 should be interpreted with deliberation. Echoing Appiah-Adu and Ranchhod (1998), although a positive relationship exists between MO and PERF, it is cautioned that other variables may influence PERF. Neglecting to examine other variables may overstate or exaggerate MO's importance (Appiah-Adu and Ranchhod 1998). Appiah-Adu and Ranchhod (1998) suggest that future studies of MO in the biotechnology industry should consider a networking or alliance variable. The following discussion of the second and third hypothesis address this concern.

5.6.2 Hypothesis 2

For over two decades, researchers have studied elements of strategic alliances and their effects on biotechnology business performance (Baum, Calabrese, and Silverman 2000; Baum and Silverman 2004; Forest and Martin 1992; George et al. 2001; George, Zahra, and Wood

2002; Silverman and Baum 2002; Sarkar, Echambadi, and Harrison 2001; Standing, Standing, and Lin 2008). Until now, no known study has measured strategic alliance management comprehensively and examined its effect on business performance in the biotechnology industry.

The second hypothesis envisaged that AO has a positive and significant effect on business performance. Results showed that the independent variable AO had a positive and statistically significant effect on the dependent variable PERF (4.8.2 Alliance Orientation and Business Performance), thus supporting H2 (Figure 5.2).



** $p < 0.001$

Figure 5.2 Model 2

Highly alliance-oriented Canadian medical/healthcare biotechnology companies achieved greater performance scores as compared to their lower alliance-oriented counterparts. Companies that are alliance-oriented acquire, interpret, and leverage strategic alliance management knowledge throughout their organizations (Kandermir, Yaprak, and Cavusgil 2006). The positive and statistically significant relationship between AO and PERF suggests that Canadian medical/healthcare biotechnology companies that monitor their environment for new partnering opportunities, engage in strategy development and knowledge sharing with their existing alliance partners, and disseminate new knowledge with their partners, outperform those that do not participate in such activities. More simply, companies that are highly alliance-oriented engage in a multitude of strategic alliance management activities with its partners (Kandermir, Yaprak, and Cavusgil 2006). This engagement in strategic alliance management

activities by Canadian medical/healthcare biotechnology companies appears to lead to increased business performance.

Support for H2 is consistent with the results from Kandermir, Yaprak, and Cavusgil's (2006) study of US technology companies and the large body of research that suggests strategic alliance management practices increase biotechnology business performance (Baum, Calabrese, and Silverman 2000; Baum and Silverman 2004; Forest and Martin 1992; George et al. 2001; Sarkar, Echambadi, and Harrison 2001). Kandermir, Yaprak, and Cavusgil (2006) found high AO resulted in strengthened performance among US technology companies. Although no known study of biotechnology companies has utilized the AO instrument, previous findings have supported Kandermir, Yaprak, and Cavusgil's (2006) three AO components. Specifically, Sarkar, Echambadi, and Harrison's (2001) found that biotechnology companies' proactive activities to obtain alliances positively affects performance, supporting the alliance scanning component. Baum, Calabrese, and Silverman (2000) found that securing partnerships at specific development stages increased biotechnology companies' performance, resembling the alliance coordination component. Forest and Martin (1992) emphasized that benefits from strategic alliances in the biotechnology industry do not come without a considerable amount of energy and commitment, validating the alliance learning component.

To reiterate, Canadian medical/healthcare biotechnology companies with high AO scores outperformed those with lower AO scores, providing support for the second hypothesis. As with the result of the first hypothesis, a company's commitment to AO does not solely perpetuate high business performance, thus the result of H2 should also be interpreted with caution.

5.6.3 Hypothesis 3

Marketing and strategic alliance management competencies have been cited as critical to the success of biotechnology companies (Hourd and Williams 2008; Yim and Weston 2007).

Previous studies of biotechnology companies found that the relationship between MO and performance was positive and significant (Appiah-Adu and Ranchhod 1998; Renko, Carsrud, and Brannback 2009). The finding from the first hypothesis confirmed that Canadian medical/healthcare biotechnology companies with high MO scores outperformed companies without such scores. Strategic alliance management competencies have been shown to increase the performance of biotechnology companies (Baum, Calabrese, and Silverman 2000; Baum and Silverman 2004; Forest and Martin 1992; George et al. 2001; Sarkar, Echambadi, and Harrison 2001). The finding from the second hypothesis confirmed that Canadian medical/healthcare biotechnology companies with high AO scores outperformed companies without such scores.

The third hypothesis envisaged that MO and AO has a positive and significant additive effect on business performance. The results showed that AO had a positive and statistically significant effect, but MO had a non-significant effect, on PERF (4.8.3 Market Orientation, Alliance Orientation, and Business Performance), thus only partially supporting H3. Originally, MO had a statistically significant influence on PERF as the sole predictor in the model (Figure 5.1), but its influence became non-significant as AO entered the model (Figure 5.3).

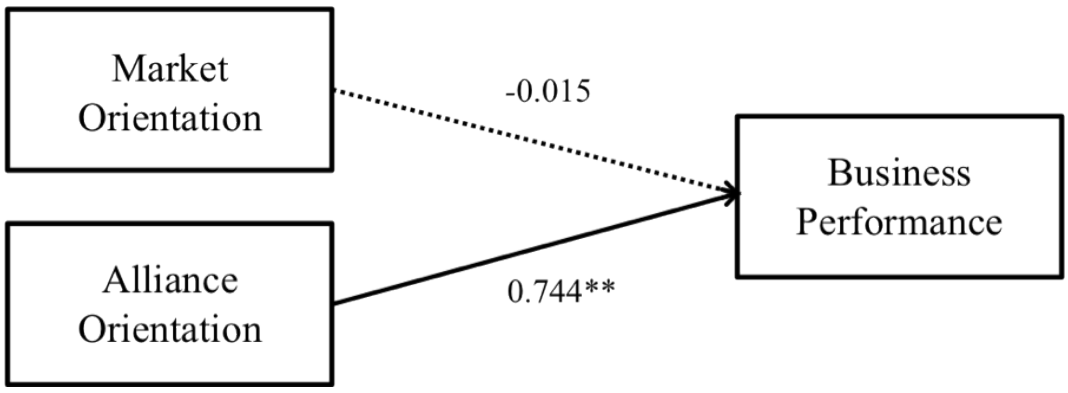
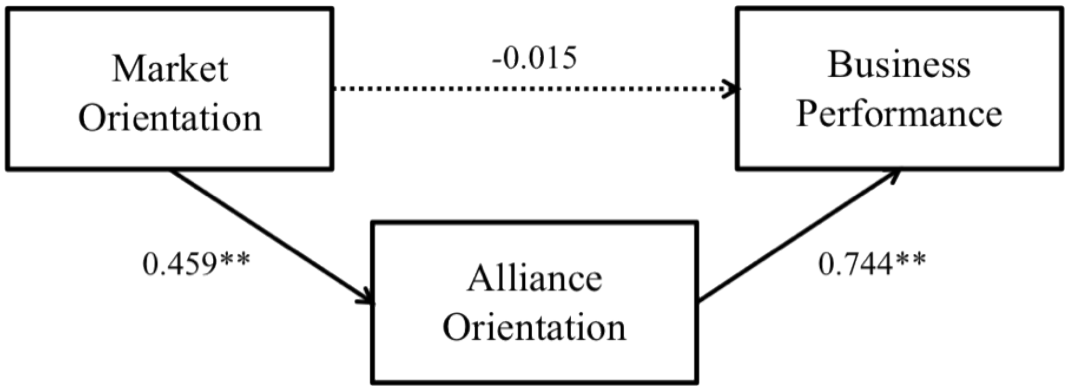


Figure 5.3 Model 3

This phenomenon (Figure 5.3) resembles the mediation relationship described by Baron and Kenny (1986). Accordingly, a fourth regression analysis was performed using the non-significant predictor (MO) as the independent variable and the statistically significant predictor (AO) as the dependent variable. The relationship between MO and AO was positive and statistically significant (4.8.4 Market Orientation and Alliance Orientation), thus supporting the existence of a mediation relationship (Figure 5.4).



** $p < 0.001$

Figure 5.4 Model 4

MO's effect on PERF is fully mediated by AO. The mediation relationship suggests that MO influences AO which in turn influences PERF. Medical/healthcare biotechnology companies with high MO scores achieved higher AO scores, and the higher AO scores resulted in increased PERF scores.

"Market orientation is the organizational culture that most effectively and efficiently creates the necessary behaviors for the creation of superior value for buyers and, thus, continuous superior performance for the business" (Narver and Slater 1990, 21). MO is an organizational culture that encourages customer-oriented, competitor-oriented, and interfunctionally-coordinated behaviours. AO is a comprised of three organizational capabilities including

alliance scanning, alliance coordination, and alliance learning (Kandermir, Yaprak, and Cavusgil 2006). "Alliance orientation will be strong when a firm possesses higher degrees of each of these capabilities and is able to skillfully configure and deploy them" (Kandermir, Yaprak, and Cavusgil 2006, 326). In the case of Canadian medical/healthcare biotechnology companies, perhaps MO is the foundation and AO is the vehicle for increasing PERF. Consequently, companies that encourage organizational behaviours including customer orientation, competitor orientation, and interfuctional coordination may be better equipped to engage in alliance scanning, alliance coordination, and alliance learning activities. Ultimately, it is the successful execution of these alliance activities that appears to increase business performance.

The Canadian medical/healthcare biotechnology industry has embraced Narver and Slater's (1990) market-oriented organizational culture, as companies in the industry understand their target markets and customers, recognize their competitors' strengths and weaknesses, and disseminate knowledge throughout their departments. Having this market-oriented organizational culture is necessary for, but does not directly influence, performance. Canadian medical/healthcare companies have adopted Kandermir, Yaprak, and Cavusgil's (2006) alliance-oriented organizational capabilities, as companies actively scan for new alliance partners, effectively manage existing alliances, and learn from its partners. The alliance management organizational capabilities act as catalyst that enable the realization of the full benefits of a market-oriented organizational culture.

5.6.4 Post-Hoc Analyses

Overall, the findings from the post-hoc regression analyses that included control variables were similar to the previous findings from the regression analyses that did not include control variables. Therefore, the findings from the post-hoc regression analyses supported the notion that MO is fully mediated by AO in its relationship with PERF. Ultimately, a sequential

relationship exists among MO, AO, and PERF, as a business' philosophy needs to be established prior to its undertaking of activities, and the execution of those practices, grounded in the organizational philosophy, perpetuates business performance.

CHAPTER 6
LIMITATIONS

The first limitation of this study was the response rate. Although this study compared favourably to similar studies in terms of the number of responses received (N = 81), the response rate was comparatively lower (20.6%). Appiah-Adu and Ranchhod (1998) received a response rate of 58.5 percent (62/106) and Renko, Carsrud, and Brannback received a response rate of 44.3 percent (85/192). Although De Luca, Veona, and Vicari (2010) reported a response rate of 53.4 percent, they actually received a response rate of 42.9 percent (70/163). Low response rates can give rise to issues related to biases, power, and generalizability. In the absence of a non-responder questionnaire, non-response bias was tested by comparing key constructs (MO, AO, and PERF) among early and late responders. Results showed no differences in the mean MO, AO, and PERF scores, thus not supporting the existence of a non-response bias. However, these post-hoc tests only provide support to move forward with other analyses and do not remedy the issue at large (Zhang 2008). Despite this study's low response rate, all regression analyses achieved acceptable power ($1-\beta \geq 0.80$). However, the fact remains that a large number of Canadian medical/healthcare companies did not respond to the questionnaire, limiting the generalizability of the findings.

The timing of the study may have negatively impacted the response rate. Specifically, data collection was conducted over the summer months, beginning in late May and ending in late August. It is possible that some executives were on holiday during the time of data collection. Accounting for this assumption, the first measure taken to increase the response rate was to extend data collection beyond the conventional time frame. Contacting BIOTECanada, the Canadian national biotechnology association, for an endorsement was the second measure taken in an attempt to increase the response rate. Obtaining an endorsement from an organization or

individual that is apart of executives' social networks has been shown to increase response rates (Bednar and Westphal 2006; Bartholomew and Smith 2006; Cycyota and Harrison 2006; Rochford and Venable 1995). The inability to secure an endorsement from BIOTECanada may have negatively impacted the response rate. However, it became apparent that securing an endorsement from BIOTECanada is beyond the control of any researcher. BIOTECanada's organizational policies prohibit it from officially supporting any study that itself does not commission. Collaboration with UQAM was the third measure taken to increase the response rate. As discussed, UQAM's support was sought to help legitimize the study within the French-speaking business community. The final measure taken to increase the response rate was the employment of a multi-modal study, giving respondents two completion options. While only 20 online responses were received, neglecting to employ a multi-modal study could have resulted in fewer responses. Despite the measures taken, the response rate is still of concern and a fundamental limitation of the study.

The next limitation was a result of the multi-modal approach. Specifically, employing a multi-modal survey can introduce additional biases. Formerly, it was cautioned that Internet users and non-users were distinctly different and that data received online may be biased toward technologically savvy respondents (Ilieva, Baron, and Healey 2002). In recent years due to the growth in the number of Internet users, this problem has lessened (Ilieva, Baron, and Healey 2002). Additionally, seeing as this study was conducted in an industry that is at the forefront of technological innovation, the issue is of even less concern. Nevertheless, key constructs (MO, AO, and PERF) among mail and online responders were compared, resulting in no statistically significant differences in mean scores. Although these post-hoc tests enable researchers to

perform further analyses, they do not resolve issues (Zhang 2008). Thus, the issue of biases related to the multi-modal approach remains a limitation of the study.

Another limitation of this study is the single-respondent approach, as one respondent per company answered questions related to marketing, alliance management, and performance. It has been shown that senior-level managers have been more reliable than other employees when it comes to providing organizational information (Phillips 1981). In an attempt to reduce the single-respondent bias, CEOs were asked to complete the questionnaires. Notwithstanding, the single-respondent bias still remains a limitation of this study.

The final limitation of the study is the scope and nature of the investigation. This study investigated the importance of marketing and strategic alliances in determining business performance, a topic that was salient to the researcher. The hypothesized antecedents were generated from literature and guided by the researcher's knowledge and interests. Although the genesis of most inquiries is a result of a researcher's interest, it is important to note the researcher's influence.

CHAPTER 7
CONCLUSION & FUTURE DIRECTIONS

Empirical data from this study lends support for the importance of market and alliance orientation in determining Canadian medical/healthcare biotechnology companies' performance. The relationship between MO and PERF was positive and statistically significant, suggesting MO was an antecedent to PERF. The relationship between AO and PERF was also positive and statistically significant, suggesting that AO was an antecedent to PERF. When MO and AO were examined together, MO became non-significant, while AO remained a statistically significant predictor of PERF. This phenomenon prompted further analyses that examined the relationship between MO and AO. The relationship between MO and AO was positive and statistically significant, supporting the existence of a mediation relationship. Specifically, MO's influence on PERF was found to be fully mediated by AO. In post-hoc analyses, that included the aforementioned control variables, these regression analyses were repeated. The post-hoc regression results supported the notion that MO's influence on PERF was fully mediated by AO. Due to the slight increase in R^2, as a result of the inclusion of the control variables, future research could investigate these control variables with a more robust sample size.

The findings from the first set of additional analyses provided no evidence to suggest MO or AO scores differed based on the response language. However, it was found that PERF scores differed based on response language. The second set of additional analyses provided no evidence to suggest MO, AO, or PERF differed based on completion method. The findings from the third set of additional analyses provided no evidence to suggest MO, AO, or PERF scores differed based on companies' geographical locations. The results from the fourth set of additional analyses indicated that the number of association memberships companies held did not influence their MO, AO, or PERF scores. The results of the fifth set of additional analyses

suggested that privately owned companies were more market-oriented than publicly traded companies. The results of the sixth set of additional analyses provided no evidence to suggest that companies' MO, AO, or PERF scores differed based on the educational backgrounds of their CEOs. The results of the seventh set of additional analyses suggested that the age of companies did not influence their MO or AO scores. However, it was found that the age of companies had a negative statistically significant effect on PERF. The findings from the final set of additional analyses provided no evidence to suggest MO, AO, or PERF scores differed based companies' size.

The findings from this study have several implications for biotechnology entrepreneurs and managers. First, the results provide evidence that behavioural orientations toward customers, competitors, and business units are the foundation needed to increase business performance. The findings also indicate that managers should pay particular attention to alliance scanning, coordinating, and learning, as these activities enable business performance. Third, managers should understand the sequential relationship between the market-oriented behavioural commitments, alliance-oriented activities, and business performance outcomes, as it can aid in business development. For instance, the sequential relationship between these behaviours, activities, and outcomes can act as a theoretical pathway to increase performance. Companies that were highly market-oriented were also highly alliance-oriented, and highly alliance-oriented companies were top performing companies. The apparent sequential relationship is not the only commercialization pathway, nor does it explain all of the behaviours and activities needed to be commercially successful, but it is important for managers and entrepreneurs to be mindful of its significance. Finally, results provided no evidence to suggest that companies' MO, AO, or PERF scores differed based on the educational backgrounds of their CEOs. It was deduced that

CEOs with specific skill sets likely surround themselves with individuals with complementary competencies. This delineates the final managerial implication that managers and entrepreneurs should surround themselves with individuals who have complementary experience, knowledge, and skills.

These findings produced several contributions to marketing and management academic research. First, Narver and Slater's (1990) MO instrument proved to be successful with an unstudied population. The instrument's success in the Canadian medical/healthcare biotechnology industry contributed to a large body of research that confirms MO positively influences performance. Second, this was the first known study to comprehensively measure strategic alliance management activities in the biotechnology industry. This study employed the underutilized Kandermir, Yaprak, and Cavusgil (2006) AO instrument, thereby expanding AO research and the use of the instrument. Moreover, the findings contribute to a large body of research that suggests strategic alliance management positively influences biotechnology performance. Third, this study goes beyond confirming MO and AO's importance in the relationship with PERF, as the existence of a mediation relationship was tested and confirmed. Fourth, and perhaps the most significant contribution was the development and successful use of the PERF instrument. The PERF instrument proved to be an effective instrument when measuring biotechnology business performance. Finally, the findings expand the scope of biotechnology marketing and strategic alliance management research. It may be fruitful to explore MO in other biotechnology subsectors, expand the use of the AO instrument in other industries and cultural contexts, utilize the newly developed and successful PERF instrument to measure biotechnology performance in other subsectors and cultural contexts, and investigate the influence of other possible antecedents to biotechnology business performance.

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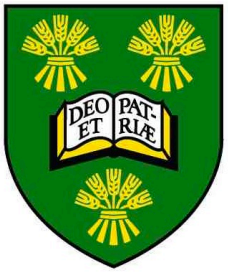
APPENDIX A



UNIVERSITY OF SASKATCHEWAN

ESG UQÀM

École des sciences de la gestion
Université du Québec à Montréal

Market Orientation, Alliance Orientation, and Business Performance in the Canadian Biotechnology Industry

1. Please specify the main operating sector of your biotechnology company:

Medical/Healthcare (Human-Focused)	Medical/Healthcare (Animal-Focused)	Agriculture/ Food	Environmental/ Industrial	Information Technology	Other
☐	☐	☐	☐	☐	_____

↳ Does you company have the potential to become human-focused?

Yes ☐ No ☐

Please check the most appropriate box when answering these questions about your company's position in the industry:

2. Our business objectives are driven primarily by customer satisfaction:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

3. Our strategy for competitive advantage is based on our understanding of customers' needs:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

4. Our business strategies are driven by our beliefs about how we can create greater value for customers:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

5. We measure customer satisfaction systematically and frequently:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

6. All business functions (e.g. marketing/sales, manufacturing, R&D, finance/accounting, etc.) share information concerning competitors' strategies:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

7. We rapidly respond to competitive actions that threaten us:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

8. Top managers regularly discuss competitors' strengths and strategies:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

9. We target customers where we have an opportunity for competitive advantage:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

10. We freely communicate information about our successful and unsuccessful customer experiences across all business functions:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

11. All business functions are integrated in serving the needs of our target markets:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

12. All business functions understand how everyone in our business can contribute to creating customer value:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

13. We share resources with other business units:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

Please check the most appropriate box when answering these questions about your company's partnerships:

14. We actively monitor our environment to identify partnering opportunities:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

15. We routinely gather information about prospective partners from various forums (e.g. trade shows, industry conventions, databases, publications, internet, etc.):

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

16. We are alert to market developments that create potential alliance opportunities:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

17. Our activities across different alliances are well coordinated:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

18. We systematically coordinate our strategies across different alliances:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

19. We have processes to systematically transfer knowledge across alliance partners:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

20. We conduct periodic reviews of our alliances to understand what we are doing right and where we are going wrong:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

21. We periodically collect and analyze field experiences from our alliances:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

22. We modify our alliance-related procedures as we learn from experience:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

Based on the last three years, please indicate the extent that your company has achieved its stated objectives in terms of:

23. Generation of new innovative products or projects:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

24. New patents:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

25. Quality and relevance of scientific output:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

26. Attainment of scientific results or milestones:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

27. Recruitment of new personnel with outstanding knowledge and skills:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

28. Scientific or technological leadership in your environment:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

29. Attainment of new capital, either public or private:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

30. Maintenance and generation of alliances or partnerships:

To No Extent	To A Small Extent	To A Moderate Extent	To A Considerable Extent	To A Great Extent
☐	☐	☐	☐	☐

Please answer the following general descriptive questions:

31. Is your company headquartered in Canada?

Yes ☐ No ☐

32. Is your company located in a biotechnology or science park?

Yes ☐ No ☐

33. If the answer to Question 32 was yes, please state the park's name _____

34. Please indicate if your company is affiliated with any of the following associations:

☐ BIOTECanada	☐ BioAtlantech	☐ BioNova	☐ Genome Canada
☐ OCRI Life Sciences	☐ Toronto Biotechnology Institute	☐ MaRS Discovery District	☐ Pharmabio Development
☐ BioQuebec	☐ Parc Technologique du Quebec Metropolitain	☐ Canadian Genetic Diseases Network	☐ Alberta Research Council
☐ BioAlberta	☐ LifeScience Association of Manitoba	☐ British Columbia Life Sciences	☐ Prince Edward Island BioAlliance
☐ Ag-West Bio Inc.	☐ Biotechnology Industry Association	☐ Newfoundland and Labrador Association of Technology Industries	
☐ BioTalent Canada	☐ Other _____		

35. What is your company's ownership structure?

Privately Owned	Publicly Traded	Subsidiary	Government	Other
☐	☐	☐	☐	_____

36. What is the CEO or President's educational background? _____

37. What year was your company founded? _____

38. How many individuals does your company employ? _____

39. What are the first three letters of your company's postal code? _____

Please provide any additional comments, suggestions, or concerns in the section below:

The portion below will be separated from the above questionnaire before any responses are put into a database so that your responses are not identifiable by any information provided below.

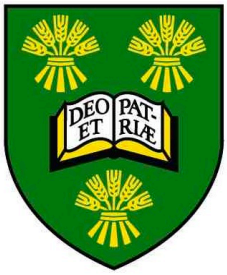
✂ -

Once the responses from this survey have been compiled and analyzed, would you like to receive a summary of the findings?

☐ Yes via e-mail ______________________________
(please provide e-mail address)
☐ Yes via postal mail ______________________________
(please provide postal address) ______________________________

Thank you for participating in this study – your time and willingness to participate is greatly appreciated!

APPENDIX B



UNIVERSITY OF SASKATCHEWAN

ESG UQÀM

École des sciences de la gestion
Université du Québec à Montréal

Orientation marché, orientation d'alliance et performance d'entreprise dans l'industrie canadienne de biotechnologie

1. Veuillez s'il vous plaît spécifier le secteur d'exploitation principal de votre société de biotechnologie :

Médical/Santé (Concentrée sur l'humain)	Médical/Santé (Concentrée sur les animaux)	Agriculture/ Alimentation	Environment/ Industriel	Technologie de l'information	Autre
☐	☐	☐	☐	☐	_____

↳ Votre compagnie a-t-elle le potentiel de développer la concentration humaine?

Oui ☐ Non ☐

Veuillez s'il-vous-plaît cocher la case la plus appropriée en répondant aux prochaines questions concernant la position de votre compagnie dans l'industrie:

2. Nos objectifs d'entreprise sont principalement dirigés vers la satisfaction de nos clients :

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

3. Notre stratégie pour avoir un avantage concurrentiel est basée sur notre compréhension des besoins de nos clients:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

4. Nos stratégies d'affaires sont conduites par nos convictions concernant la façon dont nous pouvons créer plus de valeur pour nos clients:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

5. Nous mesurons systématiquement et fréquemment la satisfaction de nos clients:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

6. Toutes les fonctions de l'entreprise partagent de l'information concernant les stratégies des concurrents:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

7. Nous répondons rapidement aux actions concurrentielles qui nous menacent:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

8. La haute direction discute régulièrement des forces et des stratégies de concurrents :

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

9. Nous ciblons les clients pour lesquels nous avons l'occasion d'avoir un avantage concurrentiel:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

10. Nous communiquons librement l'information concernant nos succès et nos expériences clients infructueuses au sein de toutes les fonctions de l'entreprise:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

11. Toutes les fonctions de l'entreprise (ex.: marketing/ventes, fabrication, R&D, finance/comptabilité, etc.) sont intégrées pour répondre aux besoins de nos marchés cibles.

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

12. Toutes les fonctions de l'entreprise comprennent que chaque personne de l'entreprise est impliquée dans la création de valeur pour le client

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

13. Nous partageons des ressources avec d'autres unités d'affaire:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

Veuillez s'il-vous-plaît cocher la case la plus appropriée en répondant aux prochaines questions concernant les partenariats de votre entreprise :

14. Nous surveillons activement notre environnement afin d'identifier les occasions de partenariats:

Fortement en désaccord	En désaccord	Neutre	En accord	Fortement en accord
☐	☐	☐	☐	☐

15. Nous recueillons régulièrement de l'information concernant les partenaires potentiels par divers moyens (salons professionnels, conventions de l'industrie, bases de données, publications, internet, etc.) :

Fortement en désaccord	En désaccord	Neutre	En accord	Fortement en accord
☐	☐	☐	☐	☐

16. Nous sommes alertes aux développements dans le marché qui créent des occasions d'alliances potentielles:

Fortement en désaccord	En désaccord	Neutre	En accord	Fortement en accord
☐	☐	☐	☐	☐

17. Nos activités à travers les différentes alliances sont bien coordonnées:

Fortement en désaccord	En désaccord	Neutre	En accord	Fortement en accord
☐	☐	☐	☐	☐

18. Nous coordonnons systématiquement nos stratégies à travers différentes alliances:

Fortement en désaccord	En désaccord	Neutre	En accord	Fortement en accord
☐	☐	☐	☐	☐

19. Nous avons des processus pour systématiquement transférer la connaissance à travers les partenaires d'alliances :

Fortement en désaccord	En désaccord	Neutre	En accord	Fortement en accord
☐	☐	☐	☐	☐

20. Nous conduisons des évaluations périodiques de nos alliances pour comprendre ce que nous faisons bien et ce que nous faisons mal:

Fortement en désaccord	En désaccord	Neutre	En accord	Fortement en accord
☐	☐	☐	☐	☐

21. Nous collectons et analysons périodiquement des données issues d'expériences menées par nos partenaires :

Fortement en désaccord	En désaccord	Neutre	En accord	Fortement en accord
☐	☐	☐	☐	☐

22. Nous modifions nos procédures liées à nos alliances selon ce que nous apprenons avec l'expérience:

Fortement en désaccord	En désaccord	Neutre	En accord	Fortement en accord
☐	☐	☐	☐	☐

Sur la base des trois dernières années, veuillez indiquer dans quelle mesure votre compagnie a atteint les objectifs fixés en terme de:

23. Génération de nouveaux produits ou projets innovants:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

24. Nouveaux brevets:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

25. Qualité et pertinence de la production scientifique (scientific output):

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

26. Atteinte des résultats scientifiques ou d'étapes scientifique importantes (milestones):

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

27. Recrutement de personnel avec d'excellentes compétences et connaissances:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

28. Leadership scientifique ou technologique dans votre environnement:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

29. Acquisition de nouveau capital, qu'il soit public ou privé:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

30. Maintient et génération d'alliances ou de partenariats:

Aucunement	Dans une faible mesure	Moyennement	Dans une forte mesure	Dans une très forte mesure
☐	☐	☐	☐	☐

Veuillez s'ils-vous-plaît répondre aux questions descriptives générales suivantes:

31. Le siège social de votre compagnie est-il au Canada?

Oui ☐ Non ☐

32. Votre compagnie est-elle située dans un parc de recherche ou un technopôle ?

Oui ☐ Non ☐

33. Si la réponse à la question 32 est oui, veuillez indiquer le nom du parc : _____

34. Veuillez indiquer si votre compagnie est affiliée avec une des associations suivantes:

☐ BIOTECanada	☐ BioAtlantech	☐ BioNova	☐ Genome Canada
☐ OCRI Life Sciences	☐ Toronto Biotechnology Institute	☐ MaRS Discovery District	☐ Pharmabio Development
☐ BioQuebec	☐ Parc Technologique du Québec	☐ Genetic Diseases	☐ Alberta Research

	Métropolitain	Network	Council
☐ BioAlberta	☐ LifeScience Association of Manitoba	☐ British Columbia Life Sciences	☐ Prince Edward Island BioAlliance
☐ Ag-West Bio Inc.	☐ Biotechnology Industry Association	☐ Newfoundland and Labrador Association of Technology Industries	
☐ BioTalent Canada	☐ Autre ______________________		

35. Quelle est la structure de propriété de votre compagnie?

Privée	Société cotée en bourse	Filiale	Organisation gouvernementale	Autre
☐	☐	☐	☐	________________

36. Quel est le niveau d'étude du Président ou PDG? __________________

37. En quelle année votre compagnie a-t-elle été créée? __________________

38. Combien d'employés votre compagnie compte-t-elle? __________________

39. Quelles sont les 3 premiers caractères du code postal de votre compagnie? __________________

Veuillez s'il-vous-plaît fournir tout commentaire, suggestion ou préoccupation dans la section ci-dessous:

La portion ci-dessous sera séparée du reste du questionnaire avant que les réponses ne soient mises dans une base de données afin que vos réponses ne soient pas identifiables par aucune des informations fournies ci-dessous.

- -

Une fois les réponses à ce sondage compilées et analysées, désireriez-vous recevoir un sommaire des résultats?

☐ Oui par courriel (S'il-vous-plaît fournir votre adresse courriel) ____

☐ Oui par la poste (S'ils-vous-plaît fournir votre adresse postale) ____

____

Merci d'avoir participé à cette étude – Votre temps et votre volonté à participer sont grandement appréciés!

APPENDIX C

Market Orientation (Adapted) – Narver and Slater (1990)

Customer Orientation

1. Our business objectives are driven primarily by customer satisfaction.
2. Our strategy for competitive advantage is based on our understanding of customers' needs.
3. Our business strategies are driven by our beliefs about how we can create greater value for customers.
4. We measure customer satisfaction systematically and frequently.

Competitor Orientation

5. All business functions share information concerning competitors' strategies.
6. We rapidly respond to competitive actions that threaten us.
7. Top managers regularly discuss competitors' strengths and strategies.
8. We target customers where we have an opportunity for competitive advantage.

Interfunctional Coordination

9. We freely communicate information about our success and unsuccessful customer experiences across all business functions.
10. All business functions (e.g. marketing/sales, manufacturing, R&D, finance/accounting, etc.) are integrated in serving the needs of our target markets.
11. All business functions understand how everyone in our business can contribute to creating customer value.
12. We share resources with other business units.

NOTES: 1 = *to no extent*, 2 = *to a small extent*, 3 = *to a moderate extent*, 4 = *to a considerable extent*, 5 = *to a great extent*.

APPENDIX D

Alliance Orientation – Kandemir, Yaprak, Cavusgil (2006)

Alliance Scanning

1. We actively monitor our environment to identify partnering opportunities.
2. We routinely gather information about prospective partners from various forums (e.g. trade shows, industry conventions, databases, publications, internet, etc.)
3. We are alert to market developments that create potential alliance opportunities.

Alliance Coordination

4. Our activities across different alliances are well coordinated.
5. We systematically coordinate our strategies across different alliances.
6. We have processes to systematically transfer knowledge across alliance partners.

Alliance Learning

7. We conduct periodic reviews of our alliances to understand what we are doing right and what we are doing wrong.
8. We periodically collect and analyze field experiences from our alliances.
9. We modify our alliance related procedures as we learn from experience.

NOTES: 1 = *strongly disagree*; 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*.

APPENDIX E

R&D Effectiveness – De Luca, Verona, and Vicari (2010)

Rate the extent to which in the last three years your company's R&D has achieved its stated objectives in terms of:

1. Generation of new innovative projects.
2. New patents.
3. Quality and relevance of scientific output.
4. Industry reputation for scientific results.
5. Generation of new knowledge on target technology/market domains.
6. Ability to attract and recruit new scientist with outstanding knowledge and skills.
7. Scientific/technological leadership in your environment.

NOTES: 1 = *to no extent*; 7 = *to a great extent*.

APPENDIX F

Business Performance

R&D Effectiveness (Adapted and Broadened) – De Luca, Verona, and Vicari (2010)

Rate the extent to which in the last three years your company has achieved its stated performance objectives in terms of:

1. Generation of new innovative products or projects.
2. New patents.
3. Quality and relevance of scientific output.
4. Attainment of scientific results or milestones.
5. Recruitment of new personnel with outstanding knowledge and skills.
6. Scientific or technological leadership in your environment.
7. Attainment of new capital, either public or private.
8. Maintenance and generation of alliances or partnerships.

NOTES: 1 = *to no extent*, 2 = *to a small extent*, 3 = *to a moderate extent*, 4 = *to a considerable extent*, 5 = *to a great extent*.

APPENDIX G

May 28, 2012

«Title»«First_Name»«Last_Name»
«Company»
«Address»
«City», «Province» «Postal_Code»

RE: Business Practices of Canadian Biotechnology Companies

Dear «Title»«Last_Name»,

This study seeks to enhance our understanding of the current business practices of Canadian biotechnology companies. The questionnaire we are asking you to complete, should take roughly 10 minutes. The questionnaire can be completed by mail and returned in the pre-stamped envelope provided, or online by visiting https://survey.qualtrics.com/SE/?SID=SV_5hFkveDPwEF0HxW and entering your identification code («CODE»). Your participation is important and we look forward to receiving your completed questionnaire. As a token of our appreciation for your participation, if you would like, the information obtained from you and other participants in the study will be aggregated and sent to your organization.

Your participation is important. However, it is completely voluntary and you do not have to complete the questionnaire. You may also refuse to answer individual questions and you may withdraw from the study at anytime. The code number on the questionnaire is designed to give the investigators the ability to track responses while keeping your identity strictly confidential. Once the data collection is complete, the list that links code numbers to names will be destroyed. Only the principal investigator (Jason Perepelkin) and co-investigator (Grant Wilson) will have access to the data arising from the study. All information will be stored in secure, locked facilities in the office of the principal investigator (Jason Perepelkin) at the University of Saskatchewan. Results will be aggregated to ensure that the identities of individual respondents are safeguarded. Results will be reported in the student-researcher's Thesis, refereed periodicals, and at conferences and meetings associated with biotechnology, pharmaceutical, and business research.

Should you have any concerns about this research project do not hesitate to contact the principal investigator (Jason Perepelkin) by e-mail (jason.perepelkin@usask.ca), phone (306-966-6992), or facsimile (306-966-6377). You completing this questionnaire, either by mail or online, constitutes consent for the researchers to use the data for the purpose of conducting the study, as this study has received exempt status from the University of Saskatchewan Behavioural Research Ethics Board (BEH 120-104, April 9, 2012). Should you have any questions regarding your rights as a participant in this study you may call the Ethics Office at the University of Saskatchewan (306-966-2084). Out of town participants may call collect.

Sincerely,

Grant Wilson, BComm MSc Candidate University of Saskatchewan	Jason Perepelkin, PhD Assistant Professor University of Saskatchewan	Marc-Antoine Vachon, PhD Candidate Professor, Department of Marketing ESG-UQAM

APPENDIX H

28 mai 2012

«Title»«First_Name»«Last_Name»
«Company»
«Address»
«City», «Province» «Postal_Code»

Objet: Les pratiques commerciales des entreprises canadiennes en biotechnologie

Bonjour «Title»«Last_Name»,

Cette étude cherche à améliorer notre compréhension des pratiques commerciales actuelles des entreprises canadiennes en biotechnologie. Le questionnaire que nous vous demandons de compléter devrait prendre environ 10 minutes. Le questionnaire peut être envoyé par la poste et retourné avec l'enveloppe préaffranchie fournie, ou en ligne au https://survey.qualtrics.com/SE/?SID=SV_1YeyyTUzqDZ9FYw en entrant votre code d'identification («CODE»). Votre participation est importante et nous espérons fortement recevoir votre questionnaire rempli. En gage de notre appréciation, si vous le désirez, les informations obtenues durant l'étude auprès des autres participants et vous seront agrégées puis envoyées à votre organisation.

Votre participation est importante. Toutefois, elle est complètement volontaire et vous n'êtes pas tenu de compléter le questionnaire. Vous pouvez également refuser de répondre aux questions individuelles et vous pouvez vous retirer de l'étude à tout moment. Le code numérique sur le questionnaire est conçu pour donner aux enquêteurs la possibilité de suivre les réponses tout en gardant votre identité strictement confidentielle. Une fois la collecte de donnée terminée, la liste liant les codes numériques aux noms sera détruite. Seul le chercheur principal (Jason Perepelkin) et le co-chercheur (Grant Wilson) auront accès aux données découlant de l'étude. Toutes les informations seront conservées dans des installations sécurisées sous verrou dans le bureau du chercheur principal (Jason Perepelkin) à l'Université de Saskatchewan. Les résultats seront regroupés pour assurer la protection de l'identité des répondants. Les résultats seront présentés dans la thèse de l'étudiant-chercheur, dans des revues scientifiques, et lors de conférences et réunions liées à la biotechnologie, à la pharmaceutique, et à la recherche commerciale.

Si vous avez des préoccupations concernant ce projet de recherche, n'hésitez pas à contacter le chercheur principal (Jason Perepelkin) par courriel (jason.perepelkin@usask.ca), par téléphone (306-966-6992), ou par télécopieur (306-966-6377). En remplissant ce questionnaire, par courrier ou en ligne, vous donnez votre consentement aux chercheurs pour qu'ils utilisent les données dans le but de conduire l'étude, tel qu'approuvé par le comité sur l'éthique en recherche comportementale de l'Université de Saskatchewan (BEH 120-104, 9 avril 2012). Si vous avez des questions quant à vos droits comme participant à cette étude, vous pouvez appeler le Bureau de l'éthique à l'Université de Saskatchewan (306-966-2084). Les participants hors région peuvent effectuer des appels à frais virés.

Sincèrement,

Grant Wilson, BComm
Candidat à la MSc
Université de Saskatchewan

Jason Perepelkin, PhD
Professeur adjoint
Université de Saskatchewan

Marc-Antoine Vachon, candidat au PhD
Professeur
Département de marketing
ESG-UQAM

APPENDIX I

RE: Business Practices of Canadian Biotechnology Companies

You recently received a request to complete a questionnaire on your company's current business practices. If you have already completed the questionnaire online or have already returned it via mail, thank you. If you have not yet completed the questionnaire and intend to do so, we would ask that you complete it as soon as possible and return it in the pre-stamped envelope provided or visit https://survey.qualtrics.com/SE/?SID=SV_5hFkveDPwEF0HxW and enter your identification code.

As you know, the purpose of this study is to understand the current business practices of Canadian biotechnology companies. As a token of our appreciation for your participation, the information obtained from you and other participants in the study will be aggregated and sent to your organization.

Your participation is important. However, it is completely voluntary and you do not have to complete the questionnaire. You may also refuse to answer individual questions and you may withdraw from the study at anytime. Should you have any concerns about this research project do not hesitate to contact the principal investigator (Jason Perepelkin) by e-mail (jason.perepelkin@usask.ca), phone (306-966-6992), or facsimile (306-966-6377).

Sincerely,

Grant Wilson, BComm
MSc Candidate
University of Saskatchewan

Jason Perepelkin, PhD
Assistant Professor
University of Saskatchewan

Marc-Antoine Vachon, PhD Candidate
Professor, Department of Marketing
ESG-UQAM

APPENDIX J

Objet: Les pratiques commerciales des entreprises canadiennes en biotechnologie

Vous avez récemment reçu une demande pour répondre à un questionnaire concernant les pratiques commerciales actuelles de votre entreprise. Si vous avez déjà rempli le questionnaire en ligne ou l'avez déjà acheminé par la poste, merci. Si vous n'avez pas rempli le questionnaire mais vous avez l'intention de le faire, nous vous demanderions de le remplir le plus tôt possible et de le retourner avec l'enveloppe préaffranchie, ou d'accéder au https://survey.qualtrics.com/SE/?SID=SV_1YeyyTUzqDZ9FYw et d'entrer votre code d'identification.

Comme vous le savez, l'objectif de cette étude est de comprendre quelles sont les pratiques commerciales actuelles des entreprises canadiennes en biotechnologie. En gage de notre appréciation, si vous le désirez, les informations obtenues durant l'étude auprès des autres participants et vous seront agrégées puis envoyées à votre organisation.

Votre participation est importante. Toutefois, elle est complètement volontaire et vous n'êtes pas tenu de compléter le questionnaire. Vous pouvez également refuser de répondre aux questions individuelles et vous pouvez vous retirer de l'étude à tout moment. Si vous avez des préoccupations concernant ce projet de recherche n'hésitez pas à contacter le chercheur principal (Jason Perepelkin) par courriel (jason.perepelkin@usask.ca), par téléphone (306-966-6992), ou par télécopieur (306-966-6377).

Sincèrement,

Grant Wilson, BComm
Candidat à la MSc
Université de Saskatchewan

Jason Perepelkin, PhD
Professeur adjoint
Université de Saskatchewan

Marc-Antoine Vachon, candidat au PhD
Professeur
Département de marketing
ESG-UQAM

APPENDIX K

June 25, 2012

«Title»«First_Name»«Last_Name»
«Company»
«Address»
«City», «Province» «Postal_Code»

RE: Business Practices of Canadian Biotechnology Companies

Dear «Title»«Last_Name»,

You recently received a request to complete a questionnaire regarding your company's current business practices. If you have already completed the questionnaire online or have already returned it via mail, thank you. If you have not yet completed the questionnaire and intend to do so, we would ask that you complete it as soon as possible and return it in the pre-stamped envelope provided or visit https://survey.qualtrics.com/SE/?SID=SV_5hFkveDPwEF0HxW and enter your identification code («CODE»). Your participation is important and we look forward to receiving your completed questionnaire.

As you know, the purpose of this study is to understand the current business practices of Canadian biotechnology companies. As a token of our appreciation for your participation, if you would like, the information obtained from you and other participants in the study will be aggregated and sent to your organization.

Should you have any concerns about this research project do not hesitate to contact the principal investigator (Jason Perepelkin) by e-mail (jason.perepelkin@usask.ca), phone (306-966-6992), or facsimile (306-966-6377). You completing this questionnaire, either by mail or online, constitutes consent for the researchers to use the data for the purpose of conducting the study, as this study has received exempt status from the University of Saskatchewan Behavioural Research Ethics Board (BEH 120-104, April 9, 2012). Should you have any questions regarding your rights as a participant in this study you may call the Ethics Office at the University of Saskatchewan (306-966-2084). Out of town participants may call collect.

Sincerely,

Grant Wilson, BComm
MSc Candidate
University of Saskatchewan

Jason Perepelkin, PhD
Assistant Professor
University of Saskatchewan

Marc-Antoine Vachon, PhD Candidate
Professor, Department of Marketing
ESG-UQAM

APPENDIX L

25 juin 2012

«Title»«First_Name»«Last_Name»
«Company»
«Address»
«City», «Province» «Postal_Code»

Objet: Les pratiques commerciales des entreprises canadiennes en biotechnologie

Bonjour «Title»«Last_Name»,

Vous avez récemment reçu une demande pour répondre à un questionnaire concernant les pratiques commerciales actuelles de votre entreprise. Si vous avez déjà rempli le questionnaire en ligne ou l'avez déjà acheminé par la poste, merci. Si vous n'avez pas rempli le questionnaire mais vous avez l'intention de le faire, nous vous demanderions de le remplir le plus tôt possible et de le retourner avec l'enveloppe préaffranchie, ou d'accéder au https://survey.qualtrics.com/SE/?SID=SV_1YeyyTUzqDZ9FYw et d'entrer votre code d'identification («CODE»). Votre participation est importante et nous espérons fortement recevoir votre questionnaire rempli.

Comme vous le savez, l'objectif de cette étude est de comprendre quelles sont les pratiques commerciales actuelles des entreprises canadiennes en biotechnologie. En gage de notre appréciation, si vous le désirez, les informations obtenues durant l'étude auprès des autres participants et vous seront agrégées puis envoyées à votre organisation.

Si vous avez des préoccupations concernant ce projet de recherche, n'hésitez pas à contacter le chercheur principal (Jason Perepelkin) par courriel (jason.perepelkin@usask.ca), par téléphone (306-966-6992), ou par télécopieur (306-966-6377). En remplissant ce questionnaire, par courrier ou en ligne, vous donnez votre consentement aux chercheurs pour qu'ils utilisent les données dans le but de conduire l'étude, tel qu'approuvé par le comité sur l'éthique en recherche comportementale de l'Université de Saskatchewan (BEH 120-104, 9 avril 2012). Si vous avez des questions quant à vos droits comme participant à cette étude, vous pouvez appeler le Bureau de l'éthique à l'Université de Saskatchewan (306-966-2084). Les participants hors région peuvent effectuer des appels à frais virés.

Sincèrement,

Grant Wilson, BComm
Candidat à la MSc
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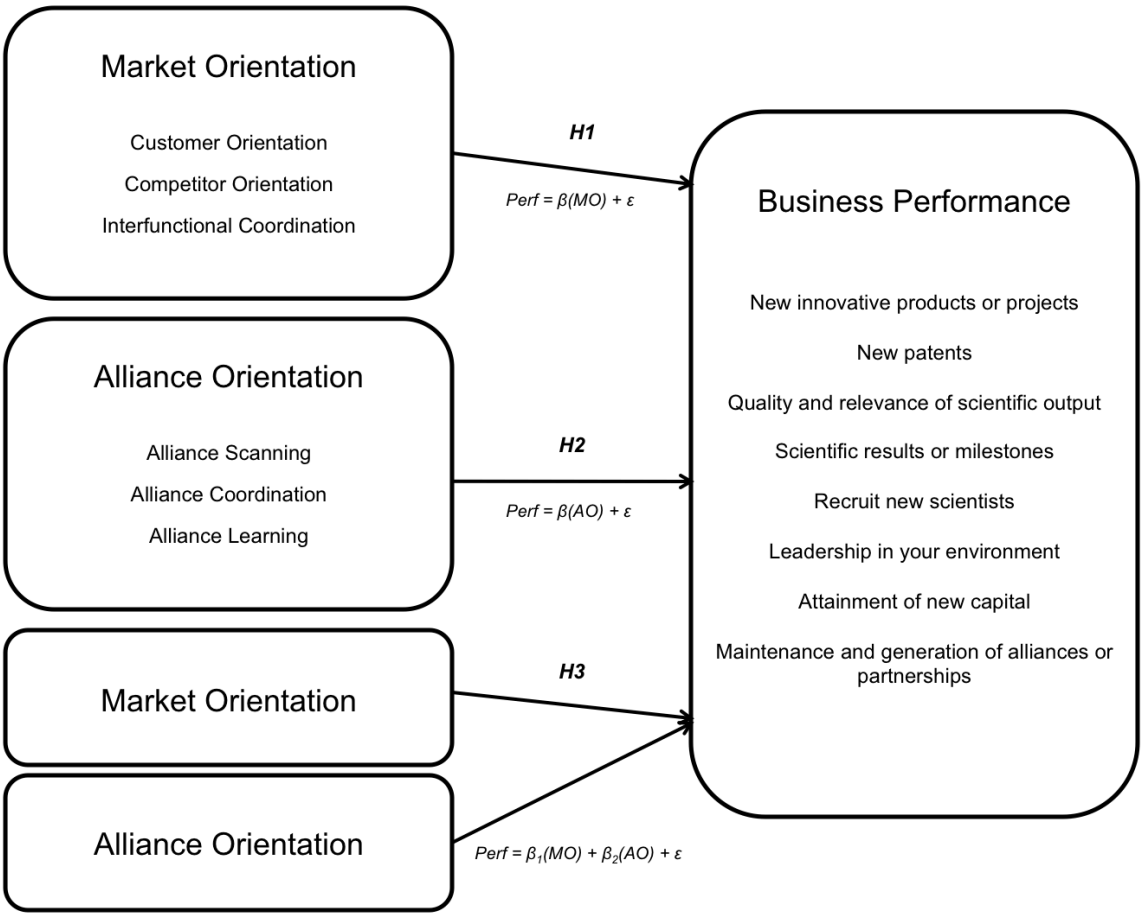
Jason Perepelkin, PhD
Professeur adjoint
Université de Saskatchewan

Marc-Antoine Vachon, candidat au PhD
Professeur
Département de marketing
ESG-UQAM

APPENDIX M


Market Orientation
Customer Orientation
Competitor Orientation
Interfunctional Coordination
H1
Perf = β(MO) + ε
Alliance Orientation
Alliance Scanning
Alliance Coordination
Alliance Learning
H2
Perf = β(AO) + ε
Market Orientation
H3
Alliance Orientation
Perf = β1(MO) + β2(AO) + ε
Business Performance
New innovative products or projects
New patents
Quality and relevance of scientific output
Scientific results or milestones
Recruit new scientists
Leadership in your environment
Attainment of new capital
Maintenance and generation of alliances or partnerships

APPENDIX N


Edmonton (9)
Vancouver (14)
Richmond/Burnaby (5)
Victoria (2)
Calgary (3)
Saskatoon (1)
Winnipeg (1)
Thunder Bay (1)
Rimouski (1)
Charlottetown (2)
Mabou (1)
Quebec City (3)
Montreal/Laval (10)
Halifax/Dartmouth (2)
Saint-Romuald (1)
Ottawa (1)
Richmond Hill /Vaughan (3)
Guelph (2)
Toronto/Mississauga (13)
Oakville (1)
Windsor (1)
London (4)