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Business Models and Performance of International Construction Companies

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Abstract: As the construction business environment becomes ever more competitive and intense, business models are receiving considerable attention as potential sources of sustainable survival and growth. In order to design sustainable business models in today's global construction market, it is important to understand the business models that would make a construction company achieve higher performance in terms of profitability, growth and market competitiveness. Therefore, this study identifies the business model variables of international construction and statistically analyzes the relationship between business model variables and firm performance guiding 72 international construction companies over a six-year period from 2009 to 2014. We examine the effect of business model variables on firm performance and how different business model variables can lead to different outcomes. The results show that business models play significant roles in determining the performance of international construction companies, with financial resources being a major determinant of profitability and regional diversification a major determinant of revenue growth and market competitiveness. Each business model variable had a different effect on profitability, growth and market competitiveness. This confirms that there are ideal combinations of business model variables that can help firms achieve higher performance. These findings are expected to provide useful guidance to assist executives' decision making when designing a business model that will enable their firm to thrive in the global marketplace.

Keywords: business model; quantitative analysis; firm performance; international construction companies

1. Introduction

The construction industry has been characterized by poor performance for decades [1], with many of its problems through to arise from low-bid tendering. As construction companies extend their operations to the worldwide stage, they face fierce foreign competition and are forced to propose lower costs and greater operational flexibility than their competitors in order to win contracts [1,2]. Cost cutting is the only way to be awarded contracts at the project level, but this often comes at the expense of worse performance for construction companies. For this reason, construction companies are increasingly interested in understanding the potential sources of competitive advantage at the corporate level. Nowadays, business models are receiving considerable attention and are becoming essential for the sustainable survival and growth of companies in many fields. A company's business model refers to the underlying logic of how that company operates and creates value for its stakeholders [3–7]. Scholars have suggested that a company's business model may be a major source of competitive advantage and superior performance [8,9].

Every organization has a business model, but most business models are never explicitly stated [4,5]. The business model framework serves as a useful tool to identify the business model by transforming the various implicit ideas about a company's business model into a common language [10]. In this regard, a number of previous studies developed business model frameworks [1,3,6,7,11–17]. Based on these business model frameworks, several researchers attempted to analyze business models of construction companies [1,16,18,19].

However, these studies did not quantitatively prove whether the business model indeed determines the performance of construction companies. Also, they did not provide information on which decisions about the business model could improve the performance of construction companies. Since the existing business model frameworks consist of components that narratively describe the logic of how a company does business, previous studies cannot quantitatively identify the business models of construction companies. Instead of quantifying, they employed a case study methodology, which is conducted by opinion surveys or interviews of managers. A case study can qualitatively explain particular business model contributions to competitive advantage. However, extant relevant studies in construction industry performed case studies involving one or a few cases in one specific region (i.e., Norway, Finland). It is too small samples to provide a generalized understanding of the relationship between business models and firm performance.

In an effort to address these issues, this study identifies business model variables of international construction companies in a quantitative manner and then goes on to analyze the relationships between business model variables, and the performance of international construction companies using statistical techniques. Specifically, we examine the effects of business model variables on the performance of international construction companies to identify what business model variables influence firm performance. Also, the differences between the business model variables are examined in the light of the firms' performance to identify the business model variables, which enabled firms to outperform their competitors. Business model variables that can be measured by financial information are selected considering data accessibility of multiple construction companies in different countries. Construction companies make decisions regarding their business model with the expectation that it will lead to better performance, such as increasing profitability, facilitating growth, and achieving a higher level of market power. Therefore, to examine whether a business model can meet these expectations, this study employs Return on Asset (ROA), revenue growth and market share, which are widely used in previous literature, as the performance variables of profitability, growth and market power, respectively [20–23]. The findings of this study are expected to provide useful guidance for executives of construction companies seeking to design and implement better business models that will improve their firm's performance in the international construction market. This paper is organized as follows. First, a literature review is presented to describe prior research on business model frameworks and business model analyses. Then, we identify business model variables of international construction companies and quantitatively analyze the relationship between business model variables and firm performance. Finally, the results of the statistical analysis are discussed, along with the significance of the findings.

2. Literature Review

Business model generally represents the underlying logic of how to run a business based on value creation, where some benefit for the client is created in terms of a product or service provided by the firm, and value capture, where the company makes a profit or receives some other form of return in exchange for the created value [3–7]. Managers often find it difficult to identify their firm's business model in a clear way because business models exist only as an abstract concept [10]. Formalizing and expressing business models in a more tangible way helps managers to communicate and share their understanding of business logic with other managers. A business model framework can, therefore, be a useful way to identify the business logic of their company [10]. A number of previous studies attempted to develop business model frameworks. Such frameworks are typically composed of a number of different components as shown in Table 1.

Table 1. Business model components in the previous studies.

Researchers	Business Model Components
Chesbrough and Rosenbloom (2002)	value proposition, market segment, value chain, cost structure, profit potential, value network, and competitive strategy
Magretta (2002)	value proposition, customer and revenue sources
Hedman and Kalling (2003)	customers, competitors, offering, activities and organization, resources, supply of factor and production inputs and the scope of management
Morris et al. (2005)	offering, market factors, internal capability factors, competitive strategy factors, economic factors, and growth/exit factors
Osterwalder et al. (2005)	value proposition, partners, activities, resources, customer relationships, channels, customer segments, cost structure, and revenue streams
Shafer et al. (2005)	strategic choices, value network, create value and capture value
Kujala et al. (2010)	customers, value proposition for the customer, competitive strategy, position in the value network, supplier's internal organization and its key capabilities and logic of revenue generation
Wikström et al. (2010)	value and flexibility, organization, innovation and growth, competence and assets, relationships and collaboration
Mokhlesian and Holmén (2012)	value proposition, value configuration, customer interfaces, target customer, customer handling, capability, cost structure, revenue model and partner network
Mutka and Aaltonen (2013)	offering, resources and capabilities, internal organization and activities, revenue creation logic, customer, value proposition, partner network, and competitive strategy
Pekuri et al. (2014)	value creation system, offering, and revenue model

In order to identify the value creation/value capture system for a given company, these components need to be both general and comprehensive, if they are to be able to grasp the specifics of the value generation process in different industries [24]. They should also be oriented toward the commonly used distinctions between the various decision levels within a company, namely the normative, tactical, and operative levels [24]. Consequently, a business model framework should consist of components that are reasonably simple, logical, measurable, comprehensive, and operationally meaningful, if it is to be useful [13]. However, existing business model frameworks tend to include only general and comprehensive components that cannot reflect differences in industry characteristics. Although existing business model frameworks may be able to describe the logic of how companies do business narratively, they cannot be utilized to analyze business model quantitatively.

These limitations have also discouraged researchers from attempting to analyze business models for construction companies quantitatively, so most previous studies have instead conducted qualitative case studies. Bygballe and Jahre [18] examined how construction companies maintain a balance between multiple logics and how they handle tensions between them in their case study of the Norwegian construction industry. Wikström et al. [16] analyzed business models by considering case studies of six project-based firms, grouping them into three categories based on their organizational entities. Pekuri et al. [19] identified the business models utilized by eight construction companies by interviewing experienced managers and analyzing the results using the theoretical aspects of business models as a reference. The same group [1] then moved on to illustrate how a business model can be used for analyzing and managing value creation in a construction company by applying the resulting business model framework to three cases from the Finnish construction industry. In this way, previous studies have analyzed business models for a few construction companies in a specific country through opinion surveys or interview with managers. However, while this type of qualitative case study methodology can explain how specific business model contributes to competitive advantage, it cannot provide a generalized understanding of how to achieve high performance.

3. Identifying Business Model Variables of International Construction Companies

The business model framework has not yet reached a common opinion as to which components make up a business model [25]. Therefore, this study begins by defining the business model framework and selecting the relevant variables for each component applicable to overseas construction companies which seek to sustain their survival and growth. On the basis of previous studies [1,3,6,7,11–17] and brainstorming, we suggest the business model framework for the construction company which can identify the business models of construction companies as shown in Figure 1. As mentioned previously, business models generally represent the underlying logic of how to run a business based on value creation, and value capture [3–7]. Since the aim of this study is to quantitatively analyze the relationship between business models and performance of international construction companies, the business model framework was limited to select components and variables, which can collect publicly available data. For example, it was found that vertical integration is a crucial decision variable of a construction company's business through the brainstorming, but it was not included because most construction companies did not publicly offer data related to vertical integration (i.e., revenue according to material supply, design/consulting service, construction, property development, etc.).

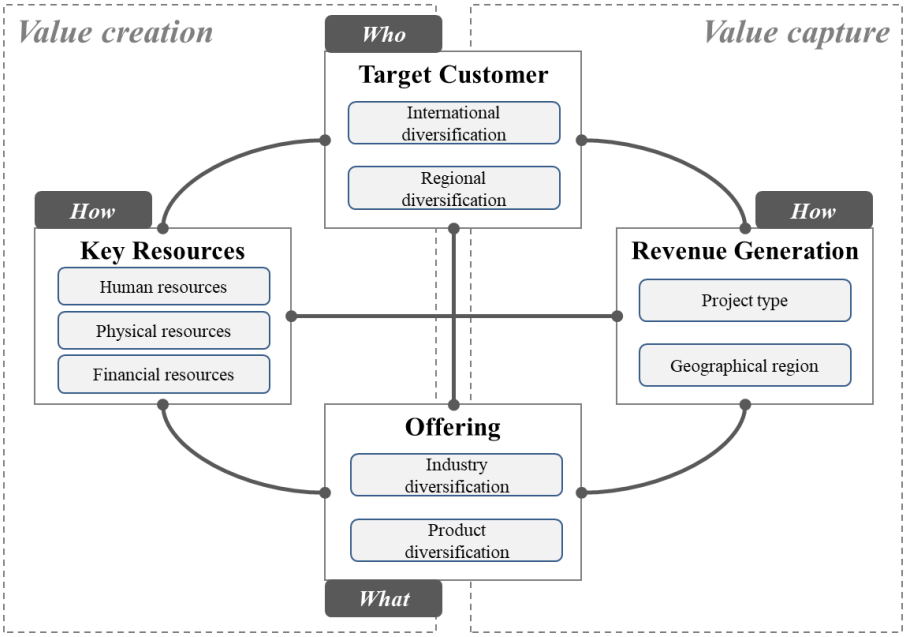

Figure 1. Business model framework for the construction company.

To provide a clear picture of value creation and value capture, this study employs dimensional questions following to the Gassmann et al. (2014). Gassmann et al. (2014) adopted four-dimensional questions which were the 'who', the 'what', the 'how' and the 'value', but this study uses the three-dimensional questions, 'who', the 'what', and the 'how'. The 'who' dimension explains who the target customer is [7]. As every business model serves a certain customer group, the target customer is one central dimension in designing the business model [13]. The 'what' dimension depicts what is offered to the target customer. It can be defined as a holistic view of a company's bundle of projects and services that are of value to the customer [10]. The 'how' dimension describes how to create the offering and how to make money. Key resources are used to create the value that firm performs relatively better than others. Revenue generation unifies aspects such as the cost structure and the applied revenue mechanism. In this respect, the proposed business model framework has four business model components: target customer, offering, key resources, and revenue generation—with respect to three-dimensional questions comprised of 'who', 'what', and 'how'. Based on the business model framework, executives can ask themselves the questions whom they should target as customers,

what product or services a company should offer, and how these activities can be delivered best to customers and how the company can make money. These components can represent common business logic of companies, but they are too generic to cover construction-specific context and too abstractive to compare business models of international construction companies over the same line. Therefore, this study selects nine measurable variables for each component considering data accessibility.

Target customer describes the segment of customers a company is seeking to offer value to [6,7,11,12,14,15]. Construction companies make a decision to expand their business into international markets and into a particular country. In this regard, this study selected international diversification and regional diversification as variables on target customers. International diversification is defined as the expansion into individual foreign countries [26] while regional diversification is defined as diversification into a relatively homogeneous cluster of countries which are physically and culturally less distant [27].

Offering refers to anything offered to the market that might satisfy a want or a need of the target customers [1,11–13]. We chose industry diversification and product diversification as variables on the offering. Industry diversification covers the growth in a business unrelated to construction that is gained by entering attractive sectors that are thought to minimize risks and increase profitability. By investing in different businesses, the overall financial risk to the construction company can be minimized, thus ensuring a stable workload and cash stabilization to balance the fluctuating nature of construction demand. Product diversification covers the entrance into construction-related products. Related diversification indicates the development of new capabilities and increasing resources (investing in new equipment, hiring new personnel, etc.) to provide new services in construction-related businesses.

Key resources describe how the offering is created [11–14]. To create the offering, a company needs resources [28]. Key resources describe the most important assets that require creating the offering to the target customer and are usually differentiated from the key resources being utilized by competitors. This study selected variables on key resources as human resources, physical resources, and financial resources. Human resources are a primary asset of construction companies [2], playing an important role in the achievement of competitive advantage because firms can select employees with high ability and train them to build unique skillsets that are difficult to imitate by other firms, which can lead to a sustained competitive advantage [29]. Physical resources refer to the level of sophistication of the technology possessed by the firm [30], encompassing the firm's physical technology, plant and equipment, geographic location, and access to raw materials [31]. Financial resources indicate a company's strength in the market in terms of its capacity to carry out projects [32]. The availability of adequate financial resources ensures the company can cope with risky situations that bring with them the prospect of high returns [32].

Revenue generation refers to how money flows into the organization and/or its sources of business [1,7,11,14,15,17]. This component measures the ability of the firm to translate the value it offers to its customers into money by generating a revenue stream. This study classified variables on revenue generation into revenue generating projects and revenue generating regions. Revenue generating projects indicates the major projects that the construction company concentrates on to produce the revenue they need if they are to continue to operate. Revenue generating projects have an impact on the construction company's resource combination, thus creating higher-order competencies and vice versa. Revenue generating regions indicates the major region in which a construction company is concentrating its efforts and generating its revenue. Construction companies can gain revenue from projects worldwide.

4. Methodology

This section describes the measurement of business model variables, performance variables and control variables followed by sampling and data collection. Statistical techniques are also presented to analyze the relationship between business model variables and the performance of international construction companies.

4.1. Measurement of the Variables

4.1.1. Business Model Variables

Following prior studies [33–36], international diversification is measured as the ratio of international revenue to its total revenue. To measure regional diversification, the entropy measures suggested by Li and Qian [26] is applied: $\sum_{i=1}^{N} P_i \ln \frac{1}{P_i}$. In this formula, N represents the number of regions; P_i is the proportion of the number of countries where a firm work in the ith region to the construction company's total number of countries in all regions. For the purposes of this study, the regions were classified into North America, Latin America, the Caribbean Islands, Europe, the Middle East, Asia/Australia, North Africa, Central and Southern Africa, and Antarctic/Arctic, as per the Engineering New Records (ENR) classifications. Industry diversification is measured as the ratio of a firm's non-construction revenue to its total revenue [35]. To measure product diversification, entropy measure used by Kim and Reinschmidt [37] and Choi and Russell [38] is applied: $\sum_{i=1}^{N} P_i \ln \frac{1}{P_i}$. In this formula, N represents the number of construction products and P_i is the ith product revenue share of the total product revenue. For the purpose of the study, product segments are classified into general building, manufacturing, water supply, sewer/water, transportation, power industry/petroleum, hazardous waste, and telecommunications as per the ENR classifications. Human resources are measured by taking the natural logarithm of the total revenue and dividing it by the total number of employees [39,40]. Physical resources are measured as capital expenditures divided by total revenue [41] and financial resources are taken to be the firm's total liabilities divided by its total equity [33,42]. Project types are classified into architecture projects, civil engineering projects, plant projects and multiple projects. Based on the ENR classifications of product segments, architecture projects include general building and manufacturing, civil engineering projects involve water supply, sewer/water and transportation, and power industry and petroleum are examples of plant projects. Following previous studies [35,43], we use 50 percent as the reference point for defining a revenue generation project in this study. Geographical regions are classified into Asia/Australia, Europe, North America and multiple regions per the ENR classification of regions. Following [44], we use 50 percent as the reference point for defining revenue generation regions.

4.1.2. Performance Variables

To examine whether a business model can increase profitability, facilitate growth and achieve high levels of market power; this study adopts multiple performance variables, return on assets (ROA), revenue growth and market share, respectively. ROA is an accountancy-based firm performance metric. ROA shows the effectiveness of the company's assets in generating profits. ROA is calculated as net income divided by average total assets [21,22]. Revenue growth is another accountancy-based measure of firm performance. Revenue growth, which is used to measure how fast a company's business is expanding, is calculated as the current year's revenue minus the prior year's revenue and then divided by the prior year's revenue [21,23]. In contrast, market share is a market-based measure of a firm's performance. Market share is a key measure of market competitiveness that indicates how well a firm is doing compared to its competitors. The main advantage of using market share is that it is less dependent upon macro-environmental variables such as the state of the economy or changing financial climates. Market share is measured as the total revenue of the company divided by the total revenue of the entire construction market [20]. For the purpose of this study, the total revenue of the construction market is taken to be the sum of the revenue of all the companies in the list of ENR's 'Top 250 International Contractors'.

4.1.3. Control Variables

To control other variables that are important to firm performance, firm size and yearly dummy are employed. Firm size is measured using the natural logarithm of its total assets [21,42,45]. Six dummy variables, one for each year from 2009 to 2014, are included to eliminate trends in the market affecting the performance of all construction companies.

4.2. Sampling and Data Collection

ENR's list of the Top 250 International Contractors (up until 2012, this list consisted of the Top 225 International Contractors) is used as a guide for company selection in this study. As the ranking of the construction companies varies over time, only firms that were included in the list at least three times from 2009 to 2014 were selected. In order to minimize the effects of special economic, environmental conditions, the analysis conducted for this study focuses on the business model of construction companies after 2008—when there was a global economic crisis. In addition, only publicly listed firms are included to facilitate data collection as these firms provide easier access to information pertaining to their operations than privately owned companies. A total of 72 international construction companies are therefore included in this study: 36 from Asia/Australia (South Korea, China, Japan, Australia, Taiwan and India), 26 from Europe (Spain, the U.K., Italy, Germany, France, Greece, the Netherlands, Portugal, Denmark, Austria and Sweden), and 10 from North America (Canada and the United States) with publicly accessible financial information being obtained for each company through annual reports, Thomson Reutters Datastream database and ENR. Although data have been gathered for 72 construction companies over the 6-year period from 2009 to 2014, the data used to identify the firms' business models consists of just 403 firm-year observations due to missing accounting data in some years for some firms.

4.3. Statistical Techniques

Multiple regression analysis is used to analyze the effect of the business model variables on firm performance. Multiple regression analysis is a statistical technique that can be used to explore the predictive ability of a set of independent variables on one dependent measure. It can provide an assessment of the model as a whole and the relative contribution of each variable that makes up the model. We used the beta coefficient, which is the standardized coefficient of each independent variable because business model variables have different scales. Prior to analysis, Variance Inflation Factor (VIF) and Durbin-Watson statistical measures are used to check the multicollinearity between the variables of the regression model and to check the independence of residuals, respectively. Multicollinearity is considered to be acceptable if VIF is between 1 and 10 [46]. A value of Durbin-Watson close to 2 is considered appropriate, whereas a value closer to 0 or 4 is considered inappropriate [46].

A *t*-test and Pearson's Chi-square test are also used to analyze how different aspects of the business model variables vary with firm performance. Prior to the analyses, the construction companies are divided into an outperforming group and an underperforming group in order to compare the business model variables associated with each performance group. The mean value of the performance variable is used as the cut-off point separating the two groups. Finally, differences in the business model variables between two groups are identified by conducting a *t*-test for continuous variables (i.e., international diversification, regional diversification, industry diversification, product diversification, human resources, physical resources and financial resources) and Pearson's Chi-square test for categorical variables (i.e., project type and geographical region).

5. Results and Discussions

This section provides two different results of the analyses. To explore the effect of business model variables on the performance of international construction companies, the multiple regression analysis

was performed. The *t*-test and Pearson's Chi-square test were conducted to examine the differences between the business model variables in the light of the firm's performance.

5.1. Effect of Business Model Variables on Firm Performance

This study examined the effect of business model variables on firm performance to explain what decisions on business model determine firm performance. The VIF and Durbin-Watson test for each of three different performance variables were all found that multicollinearity does not exist. The variables of the business model explain 17 percent of the variance in ROA as shown in Table 2. Regional diversification (beta = 0.118) and industry diversification (beta = 0.131) both had positive relationships with ROA at 95% and 99% significance levels, respectively, whereas human resource (beta = −0.116) and financial resource (beta = −0.336) were negatively related to ROA at 95% and 99% significance levels, respectively. The results also indicated that generating revenue from the North American region (beta = −0.188) had a more strongly negative effect on ROA than that generated in the Asia/Australia region. The financial resource had the strongest effect on ROA because it shows the largest beta value. However, international diversification, product diversification, physical resource and project type of generating revenue all failed to achieve the required level of significance.

Table 2. Effect of business models on ROA.

Business Model Variables	Beta	Significance Level	VIF
International diversification	0.042	0.521	2.044
Regional diversification	0.118	0.022	1.275
Industry diversification	0.131	0.009	1.200
Product diversification	0.068	0.212	1.438
Human resources	−0.116	0.047	1.669
Physical resources	0.039	0.443	1.243
Financial resources	−0.336	0.000	1.418
Project type dummy1	−0.069	0.301	2.167
Project type dummy2	0.025	0.720	2.396
Project type dummy3	−0.083	0.175	1.834
Geographical region dummy 1	−0.008	0.900	2.007
Geographical region dummy 2	−0.188	0.001	1.406
Geographical region dummy 3	0.054	0.375	1.814
R^2 (Adj.R^2)		0.203 (0.177)	
F		7.631 ***	
Durbin-Watson		1.977	

Note: Firm size and dummy variables for year are included in the analyses but not shown here. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The variables of the business model also explained 7 percent of the variance in revenue growth as shown in Table 3. International diversification (beta = −0.198) had a negative relationship with revenue growth, whereas regional diversification (beta = 0.202) had a positive relationship with revenue growth at a 99% significance level. Generating revenue from plant projects (beta = 0.170) and multiple projects (beta = 0.141) had more positive effects on revenue growth than architecture projects. As was the case with ROA, generating revenue from North the American region has a more strongly negative effect on revenue growth than was the case for the Asia/Australia region. Regional diversification showed the strongest effect on revenue growth, but industry diversification, product diversification, human resource, physical resource and financial resource were not satisfactorily correlated with revenue growth.

Table 3. Effect of business models on revenue growth.

Business Model Variables	Beta	Significance Level	VIF
International diversification	−0.198	0.004	2.044
Regional diversification	0.202	0.000	1.275
Industry diversification	0.012	0.825	1.200
Product diversification	−0.088	0.127	1.438
Human resources	0.038	0.542	1.669
Physical resources	0.012	0.821	1.243
Financial resources	0.092	0.109	1.418
Project type dummy1	−0.048	0.498	2.167
Project type dummy2	0.170	0.023	2.396
Project type dummy3	0.141	0.031	1.834
Geographical region dummy 1	−0.084	0.216	2.007
Geographical region dummy 2	−0.125	0.029	1.406
Geographical region dummy 3	−0.095	0.143	1.814
R^2 (Adj.R^2)		0.101 (0.071)	
F		3.351 ***	
Durbin-Watson		1.809	

Note: Firm size and dummy variables for year are included in the analyses but not shown here. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The biggest effect was on market share, where the variables of the business model explained 36 percent of the variance. The variables of the business model also explained 7 percent of the variance in revenue growth as shown in Table 4. International diversification (beta = −0.261) had a negative relationship, whereas regional diversification (beta = 0.437) had a positive relationship with market share at a 99% significance level. Human resource (beta = −0.143) and physical resource (beta = −0.135) are both negatively related to market share. Contrary to the relationship with ROA, financial resource (0.164) was positively related to market share at a 99% significance level. Generating revenue from plant projects (beta = −0.175) had a more strongly negative effect on market share than that architecture projects. In addition, generating revenue from Europe (beta = −0.201), North America (beta = −0.270) and multiple regions (beta = −0.166) all had a more negative effect on market share than that generated from Asia/Australia. As with revenue growth, regional diversification had the strongest effect on market share, while both industry diversification and product diversification failed to achieve the required level of significance.

Table 4. Effect of business models on market share.

Business Model Variables	Beta	Significance Level	VIF
International diversification	−0.261	0.000	2.044
Regional diversification	0.437	0.000	1.275
Industry diversification	−0.067	0.121	1.200
Product diversification	−0.072	0.129	1.438
Human resources	−0.143	0.005	1.669
Physical resources	−0.135	0.002	1.243
Financial resources	0.164	0.001	1.418
Project type dummy1	0.081	0.168	2.167
Project type dummy2	−0.175	0.004	2.396
Project type dummy3	0.007	0.900	1.834
Geographical region dummy 1	−0.201	0.000	2.007
Geographical region dummy 2	−0.270	0.000	1.406
Geographical region dummy 3	−0.166	0.002	1.814
R^2 (Adj.R^2)		0.389 (0.368)	
F		19.041 ***	
Durbin-Watson		1.686	

Note: Firm size and dummy variables for year are included in the analyses but not shown here. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.2. Differences of the Business Models in Terms of Firm Performance

This study focused on precisely how different aspects of the business model variables vary with firm performance to identify which business model variables helped companies outperform their rivals. We conducted three *t*-tests and Pearson's Chi-square tests for the three different performance variables. There were 208 firm-year observations in the ROA outperforming group and 195 firm-year observations in the ROA underperforming group. As shown in Table 5, the results of the *t*-test indicated statistically significant differences between the outperforming and underperforming groups with respect to ROA for international diversification (t = 3.623), regional diversification (t = 4.192), industry diversification (t = 3.776), product diversification (t = -3.311), human resource (t = −3.015) and physical (t = −8.409), all at a 99% significance level. However, the differences in physical resource fail to achieve the required significance level. The results of Pearson's Chi-square test revealed that a 99% significance level for different project types (χ^2 = 65.192) and geographical regions (χ^2 = 13.063). The ROA outperforming group exhibited higher international diversification, regional diversification, and industry diversification than the underperforming group. In addition, the ROA outperforming group generated revenue primarily from plant projects and in the Asia/Australia region, while the underperforming group generated revenue mainly from civil engineering projects and in the Asia/Australia region.

Table 5. Differences in business models in terms of return on assets (ROA).

Business Model Variables (Continuous Variables)	**O**	**U**	***t***	**Significance Level**
	Mean	**Mean**		
International diversification	49.89	39.60	3.623	0.000
Regional diversification	1.38	1.20	4.192	0.000
Industry diversification	20.84	12.30	3.776	0.000
Product diversification	0.75	0.91	−3.311	0.001
Human resources	12.85	13.08	−3.015	0.003
Physical resources	4.16	3.85	0.543	0.587
Financial resources	67.35	77.54	−8.409	0.000
(Categorical Variables)	**Freq.**	**Freq.**	χ^2	**Significance Level**
Project type_architecture	39	29	65.192	0.000
Project type_Civil engineering	27	83		
Project type_Plant	119	46		
Project type_Multi	23	37		
Geographical region_Asia & Australia	102	111	13.063	0.005
Geographical region_Europe	43	54		
Geographical region_North America	30	13		
Geographical region_Multiple	33	17		

* Note: O = outperforming, U = underperforming group.

There were 221 firm-year observations and 182 firm-year observations in the revenue growth outperforming and underperforming groups, respectively. As shown in Table 6, the results showed no significant differences for regional diversification, industry diversification, product diversification, human resource, physical resource, financial resource, and project types. However, there was a 99% level of significance for international diversification (t = −2.692) and geographical region (χ^2 = 10.801). Revenue growth in the outperforming group showed that group members had lower international diversification than members of the underperforming group and they generated more of their revenue from the Asia region compared to the others.

There were 109 firm-year observations and 294 firm-year observations in the market share outperforming and underperforming groups, respectively. As shown in Table 7, there were statistically significant differences between the market share outperforming and underperforming groups for international diversification (t = −2.458) at the 95% significance level and for regional diversification

(t = 4.721), industry diversification (t = −6.589), product diversification (t = 5.180), financial resource (t = 9.065), project types (χ^2 = 56.827) and geographical region (χ^2 = 23.713), all of which achieve a 99% significance level. However, differences in human resource and physical resource failed to satisfy the required significance level. Overall, the market share outperforming group had relatively higher regional diversification, product diversification and financial resource than the underperforming group, while international diversification and industry diversification are higher in the underperforming group. In addition, the market share outperforming group generated revenue mainly from civil engineering projects and in the Asia/Australia region, while the underperforming group generated its revenue mainly from plant projects and also in the Asia/Australia region.

Table 6. Differences in business models in terms of revenue growth.

Business Model Variables (Continuous Variables)	**O**	**U**	t	**Significance Level**
	Mean	**Mean**		
International diversification	41.42	49.15	−2.692	0.007
Regional diversification	1.31	1.26	1.186	0.236
Industry diversification	16.23	17.28	−0.451	0.652
Product diversification	0.78	0.88	−1.944	0.053
Human resources	12.99	12.93	0.818	0.414
Physical resources	4.18	3.80	0.654	0.514
Financial resources	72.42	72.12	0.227	0.821
(Categorical Variables)	**Freq.**	**Freq.**	χ^2	**Significance Level**
Project type_architecture	37	31	5.412	0.144
Project type_Civil engineering	51	59		
Project type_Plant	100	65		
Project type_Multi	33	27		
Geographical region_Asia & Australia	131	82	10.801	0.013
Geographical region_Europe	42	55		
Geographical region_North America	25	18		
Geographical region_Multiple	23	27		

* Note: O = outperforming, U = underperforming group.

Table 7. Differences in business models in terms of market share.

Business Model Variables (Continuous Variables)	**O**	**U**	t	**Significance Level**
	Mean	**Mean**		
International diversification	38.72	47.21	−2.458	0.015
Regional diversification	1.44	1.23	4.721	0.000
Industry diversification	8.57	19.72	−6.589	0.000
Product diversification	1.01	0.76	5.180	0.000
Human resources	12.94	12.97	−0.453	0.651
Physical resources	3.79	4.09	−0.634	0.526
Financial resources	79.48	69.62	9.065	0.000
(Categorical Variables)	**Freq.**	**Freq.**	χ^2	**Significance Level**
Project type_architecture	30	38	56.827	0.000
Project type_Civil engineering	46	64		
Project type_Plant	12	153		
Project type_Multi	21	39		
Geographical region_Asia & Australia	62	151	23.713	0.005
Geographical region_Europe	37	60		
Geographical region_North America	0	43		
Geographical region_Multiple	10	40		

* Note: O = outperforming, U = underperforming group.

5.3. Discussions

The ultimate goal of this study has been to derive some useful implications that will help executives of international construction companies to design sustainable business models. To do this, we first quantitatively identified the business model variables used by successful international construction companies by applying actual data for 72 international construction companies. We then moved on to analyze the effect of these business model variables on firm performance, and how differences in various aspects of the business model variables affect firm performance. The following findings and implications are expected to be useful for executives of international construction companies.

First, our findings confirmed that their business model does indeed influence the performance of international construction companies. The results of the multiple regression analysis and *t*-test / Pearson's Chi-square test with respect to three performance variables were found to be statistically significant. These findings are consistent with those of previous studies suggesting that a firm's business model plays a significant role in determining its performance and contributes to the creation of competitive advantage [8,9]. The results of our analysis provide empirical evidence in the context of the construction industry to demonstrate that executives of international construction companies should seek to develop a better understanding of their business model as a potential source of competitive advantage and superior performance. This emphasizes the importance of taking a firm's business model into consideration in today's global construction market.

Second, this research identified the determinants of firm performance in terms of the business model on the basis of the results of the multiple regression analysis with respect to three performance variables. Regional diversification, industry diversification, human resources, and financial resources were all found to be determinants of profitability; international diversification and regional diversification were determinants of growth; and international diversification, regional diversification, human resources, physical resources and financial resources were determinants of market competitiveness. This indicates decisions regarding target customers are the determinants of growth, and decisions on target customers and key resources are the determinants of market competitiveness. Each determinant has a different magnitude of influence for each performance variable; those with the highest value will be the major determinants. The major determinant of profitability is the company's financial resources and the major determinant for both growth and competitiveness is regional diversification. Executives are advised to devote additional effort to decision-making related to financial resources in order to manage their firm's profitability more effectively. In addition, decision-making on regional diversification requires more effort if firms are to manage both growth and market competitiveness effectively.

The results of the multiple regression analysis revealed that each business model variable had a different effect on profitability, growth and market competitiveness with respect to the three performance variables as shown in Figure 2. International diversification was negatively significant for growth and market competitiveness but not significant for profitability, while regional diversification had a positive influence on profitability, growth and market competitiveness and industry diversification had a positive impact on profitability alone. Interestingly, product diversification was not statistically significant for any of the performance variables. Human resources had a negative relationship with profitability and market competitiveness, but no relationship with growth. Physical resources were negatively significant, contributing only to market competitiveness, and although financial resources had a negative effect on profitability, it had a positive effect on the market competitiveness. Generating revenue from plant projects and multiple projects had a stronger positive effect on growth than architecture projects; whereas generating revenue from plant projects negatively affected market competitiveness more strongly than architecture projects. Generating revenue from the North American region had a stronger negative effect on profitability and growth than from the Asia/Australia region; generating revenue from Europe, North America and multiple regions had a more negative effect on market share than the revenue generated from the Asia/Australia region. The results of this analysis can be used by company executives to design a more effective business model that improves specific areas of firm performance.

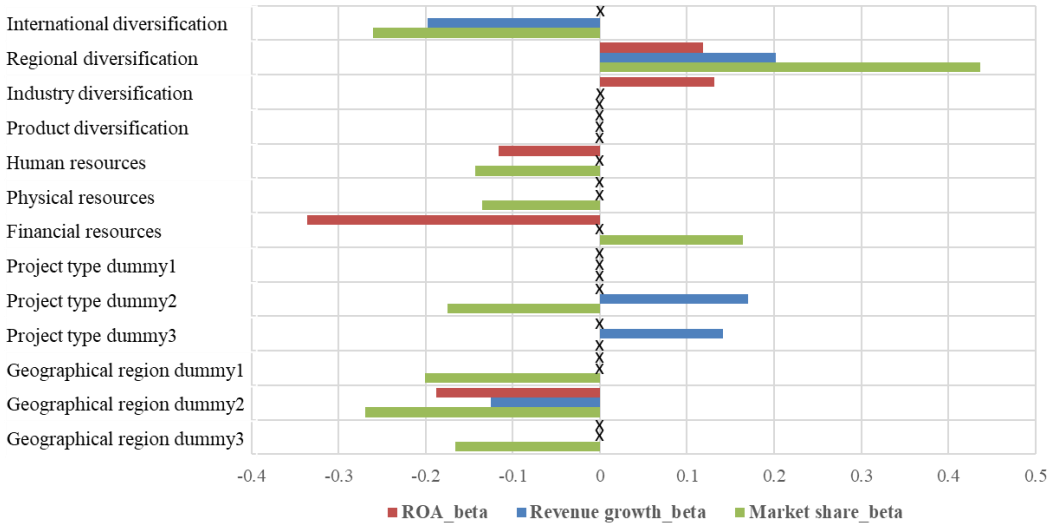

Figure 2. Comparison of standardized coefficients between business model variables.

Lastly, this study confirmed that there were ideal sets of business model variables that will help firms achieve higher performance based on the results of the *t*-test / Pearson's Chi-square test with respect to three performance variables as shown in Figure 3. International construction companies achieving better profitability had higher international diversification, higher regional diversification, higher industry diversification, lower product diversification, lower human resources, and lower financial resources. They also had a higher percentage of revenue being generated by plant projects and in the Asia/Australia region. Groups that were outperforming in terms of growth had lower international diversification and a high percentage of revenue generation in the Asia/Australia region. International construction companies with better market competitiveness had lower international diversification, higher regional diversification, lower industry diversification, higher product diversification, higher financial resources and a higher percentage of their revenue generation from civil engineering projects and by working in the Asia/Australia region. The results of this analysis will support executives seeking to compare their business model with those of their competitors and help them to design a business model that will produce high performance. Also, these findings will serve as a blueprint for best practice for companies entering the global construction market for the first time.

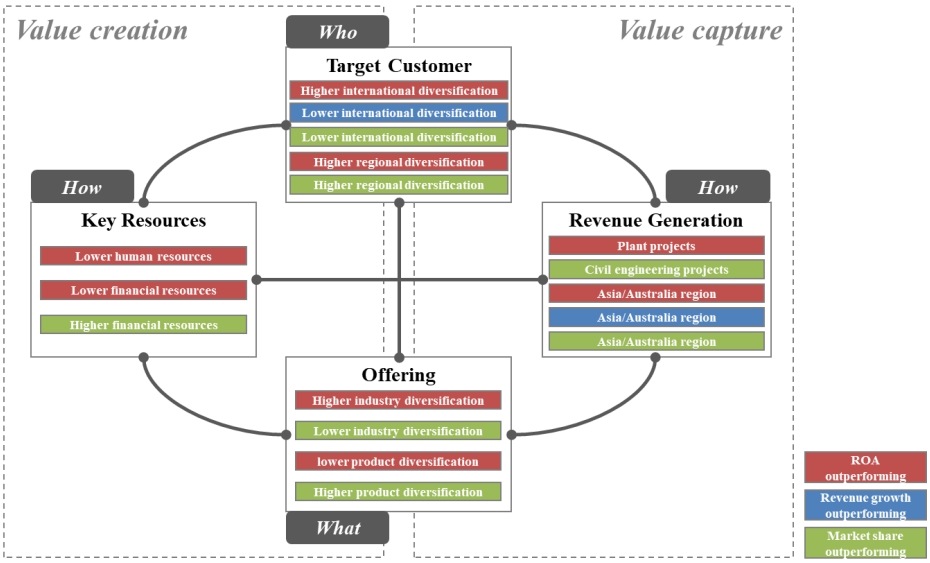

Figure 3. Business model characteristics of outperforming international construction companies.

6. Conclusions

As the construction market becomes increasingly more global, construction companies must learn to survive and thrive in today's competitive and intense international business environment. In order to achieve superior performance and competitive advantage in the globalized construction market, executives must learn how to design business models that will enable their companies to successfully navigate in this complex, high-pressure business environment. To provide a better understanding of the business model that will result in high performance, this study quantitatively identified and analyzed business models of 72 international construction companies collected from 2009 to 2014. The findings of this study provide a number of international implications: (1) the business model does indeed influence the performance of international construction companies. The analysis conducted for this study provides empirical evidence highlighting the importance of taking the business model into consideration in global construction market; (2) the determinants of firm performance for international construction companies were identified in terms of the business model. Executives are advised to put additional effort into decision-making related to both the financial resources and regional diversification in order to manage their company's profitability, growth and competitiveness effectively; (3) Variables of the business model have different effects on profitability, growth and market competitiveness. Executives should aim to design their firm's business model with reference to the analysis results when seeking to improve specific areas of firm performance; and (4) there are ideal sets of business model variables that will help companies achieve higher performance. The analysis results can serve as examples of best practice for new companies entering the global construction market.

This study makes several useful contributions to research and practice in this field. The analysis results extend our body of knowledge regarding the business model that offers potential sources of competitive advantage in the context of construction. In particular, they are expected to provide useful guidance to assist executive decision-making when designing their business model. Also, the business model framework suggested in this study can be applied to companies in other industry. It is because that the selected four components have generic characteristics and variables for each component can be selected to reflect industry-specific context. Despite the contributions of this study, however, several limitations remain. The main limitation of this study is that only nine business model variables were used to analyze the relationship between business model variables and firm performance. It was because it had difficulties to collect the same format data from multiple construction companies of different countries. If we would collect more data regarding the business model such as vertical integration, partnering and collaboration and internal structure, the business model analysis could deliver more meaningful implications. This study also neglected to consider country and company-specific characteristics. In future studies, more samples need to be analyzed using a wider range of business model variables including country and company-specific characteristics in order to achieve more generalized and meaningful results.

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