An Integrated Model of Scenario Planning, Business Model Canvas, and Financial Modeling for the Early-stage Enterprise Valuation

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Abstract

This paper reports an integrated model for evaluating an early-stage third-party mobile application developer. By combining qualitative analyses, including Business Model Canvas (BMC), strengths, weaknesses, opportunities, threats analysis, and scenario planning, as well as quantitative analysis based on financial modeling and valuation, this study not only demonstrates the viability of the proposed integrated model through a case analysis but also provides meaningful insights into the target company being investigated. The results indicate that the third-party app market competition/failure rate is the key factor for determining whether the target company must reduce its selling, general, and administrative expenses or expanding its customer segments to survive.

Keywords: Mobile Commerce, Venture Capital Valuation, Business Model Canvas, Scenario Planning, Free Cash Flow

1. Introduction

Valuation concepts are mature and prevalently applied in financially developed countries. Conventional standard valuation techniques and frameworks have long been executed in the workforce. However, valuating young start-up firms by using conventional methods is challenging because they tend not to have a substantial history, tangible assets, products, and services to sell. The absence of information concerning these firms is problematic for analysts. Consequently, most start-up firms' information is not provided publicly by service companies (Damodaran, [1]). Studies demonstrate that many scholars consider comprehending strategic analysis by combining qualitative methods and quantitative models necessary [2], whereas industrial engineering studies on computational intelligence and data science for financial decision-making rely on substantial amounts of historical data. Critically, the qualitative method called scenario planning (SP) accounts for future uncertain states [3]. Recent

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trends are to combine traditional strategy decision-making approaches with SP [4, 5, 6, 7]. However, few studies have combined SP with the conventional valuation method, that is the net present value (NPV). Additionally, use of a business model canvas (BMC) has become more and more prevalent in both the academic and industry spheres. Reputable multinational companies such as Gillette, Google, LEGO, and P&G have leveraged the business model canvas proposed by [8]. In addition, Hsu [9] evaluated US-based firms to identify how social responsibility impact their life-cycle to efficiently maintain or develop total assets. Broekhuizen et *al.* [10] investigated on what strategic choices do business leaders make when implementing new business models based on several new business model in industry. Wu et *al.*, [7] integrated SP and decision tree analysis for new product development in a case study of a smart-phone project in Taiwan. Therefore, this research aims to develop an integrated model for valuating a company whose information is not readily publicly accessible. This integrated model was developed by meeting the following objectives:

- Determine a mature and commonly-used commercial model in the industry for analyzing a company qualitatively.
- Embed a mechanism that makes the chosen commercial model more comprehensive by considering time and future uncertainties and that could reasonably produce different assumptions/drivers for the determined ideal quantitative analysis.
- Compare valuation methods provided in earlier studies and determine the optimal approach for valuating start-up firms quantitatively when no public information on the firm is readily available.
- Discuss the implications and conclusions derived by combining both qualitative and quantitative results from a case analysis and provide suggestions for the case start-up firm.

The remainder of this paper is organized as follows. Section 2 reviews the recent development of venture capital valuation and modeling approaches. Section 3 presents the uses of methods of valuation, specifically the BMC, SP, and financial modeling and valuation methods. Sections 4 outlines the results and discussions. Section 5 concludes with discussions on future research directions.

2. Literature Review

This research discovers three methods for valuating start-up companies quantitatively. All three methods focus on whether and how financial and non-financial information is considered during the quantitative valuation of start-up companies. Ehrenhard et *al.*, [11] studied how start-ups build business value by using mobile applications to develop App-based business innovation. Damodaran [1] proposes a general valuation framework with seven steps as follows: (1) assess the firm's current standing; (2) estimate revenue growth; (3) estimate a sustainable operating margin for stable growth; (4) estimate reinvestment

required to generate growth; (5) estimate risk parameters and discount rates; (6) estimate firm value; and (7) estimate the value of equity by using the NPV method. According to Barcelona, [12, 13], the NPV method considers only one scenario for decision-making and evaluates one-stage decisions without considering contingencies or changes that reflect future uncertainties. To achieve future competitive advantages when presented with constant change and uncertainty, numerous scholars propose combining traditional strategy decision-making approaches with SP [14]. To the best of our knowledge, no studies combining the NPV method with SP were found, despite the NPV method being calculable, similar to the value tree concept, and able to serve as an adequate decision analysis tool (the NPV method was found to have been combined with real option analysis, but both are quantitative analyses and thus lack qualitative methods). Finally, the concept of a BMC has developed over the years, especially the one proposed by Osterwalder & Pigneur [8].

2.1. Venture Capital Valuation

Facts support the idea that a financial statement is critical in valuating venture capital-based firms. Hand [15] assumes that the associations between equity values and financial statement data in the venture capital market would align with his economic intuition and therefore are the same as those in the public markets. By using a sample of US biotechnology firms from 1992 to 2003 and running the data into regression models to determine value relevance measured using R-squared, Hand [15] concludes that equity values are positively related to a firm's cash balances, non-cash assets, and research and development expenses, and are negatively related to its long-term debt and stock dilution. This indicates that generally accepted accounting principles (GAAP) also provide useful information to investors in the private equity market. However, he also states that financial and non-financial information are substitutes rather than complements: Non-financial statement information is more relevant in the venture capital market than is financial statement information when firms are young, and vice versa when firms are mature.

In another study, Sievers et *al.* [16] adopt Ohlson's [17, 18] equity valuation model linking firm accounting information and other non-financial information to extend on earlier studies. By adopting Ohlson's [17, 18] equity valuation model, Sievers et *al.*, [16] quote the studies by Hand [15] and Armstrong et *al.*, [19] to justify the assumption that accounting information is relevant when explaining the values of venture capital-backed firms beyond non-financial characteristics. Subsequently, they expand on the findings of prior research [20, 21], identifying five key factors expected to logically represent non-financial information regarding team quality: team composition, founding team size, management team size, chief executive officer education level, and team experience. Sievers et *al.*, [16] demonstrate that a model only considering financial statement information and deal characteristics actually explains approximately 51% of the variation in valuations. Thus, financial statement information is demonstrated to be as powerful as non-financial information in indicating venture capital-based firms' values. Second, valuations based on accounting and non-accounting information are determined to yield a level of valuation accuracy comparable with that of publicly traded firms. This level of valuation accuracy is 53% median absolute percentage error. Third, the study reveals that total asset multiples outperform revenue multiples sub-

stantially. However, valuation inaccuracies reach 68%-113% when multiples-based valuation approaches are implemented. Additionally, prediction models reach a valuation inaccuracy of 50%, indicating that using total asset and revenue multiples results in less accurate results than are obtained from the more comprehensive valuation models.

From still another perspective, Damodaran [1] argues that valuations for start-up firms are accurate only when traditional discount models are implemented. Despite young firms tending not to have substantial histories or sufficient tangible assets, as well as having negative earnings, discounted cash flow (DCF) models should not be ignored. In other words, the reliability of DCF models remains and the present value of a firm should still equal the present value of the expected cash flow from its assets, despite how difficult estimating the firms' cash flow may be. Damodaran [1] also argued, for those who proposed different models to valuate start-up firms, that weak assumptions not made explicit or tested can prove the whole valuation unrealistic. Moreover, Block et *al.*, [22] analyzed how trademarks affects the start-up valuation by venture capitals.

2.2. Scenario Planning and Strategy Development

When firms are presented with constant change and uncertainty, they must adjust their operations to satisfy vital success factors and grasp any opportunities identified in the dynamic marketplace to achieve future competitive advantages. Adding SP to strategy decision-making connects the strategy development and traditional approaches [6]. Walsh [6] attempts combining traditional strategic development approaches with SP to create competitive advantages in uncertain and evolutionary surroundings. After determining the "drivers" and "variables" that affect an environment's future state, he conceptualizes the data pertaining to the variables then develops, tests, constructs, and examines several scenarios and identifies the problems arising from within a firm. Walsh [6] concludes that applying SP to strategic development is appropriate when firms experience uncertainties in their environment. SP enables firms to gain the insights and information necessary to better analyze their performances and therefore retain or create competitive advantages in changed environments. Another study reaffirms the usefulness of combining SP with the process of strategy formation. In this study, after indicating how the external environment approach and recourse-based approach are flawed for determining strategies, the authors conclude that the design school model is appropriate for strategizing because it emphasizes both external and internal variables in a balanced fashion. The authors propose a new model that expands the traditional design school model of strengths, weaknesses, opportunities, threats (SWOT) analysis by inputting the external (opportunities and threats) and internal (strength and weakness) variables into SP. After doing so, they develop a strategy based on the SP results [4].

Acknowledging that complimenting quantitative methods with qualitative methods is necessary to comprehend strategic analysis results, Miller and Waller [5] integrate real option analysis and SP. Following this, Wu et *al.*, [7] attempt to integrate decision tree analysis and SP, stating that the real option analysis' assumptions are oversimplified, the math implementations are over-complicated, and the derived results are interchangeable with those

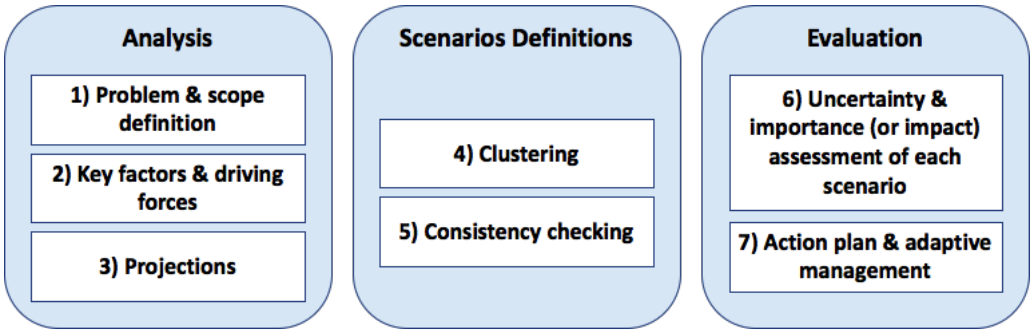

Figure 1: Recommended process for scenario analysis [26]

of decision tree analysis [23]. Wu et *al.*, [7] design an integrated model for systematically generating scenarios that accurately reflect reality.

SP investigates the range of possibilities that motivates decision-makers to consider changes that would have otherwise been ignored [24]. This aligns with the conventional financial valuation sensitivity/scenario analysis technique that determines the most integral assumptions/drivers within a model and establishes a range for them to determine how the altered assumptions influence the results. Although the process of implementing SP is defined differently, a general development process is derivable [25]. The Stanford Research Institute (1996) suggests a SP process comprising six key components: (1) a focus or decision area; (2) key decision factors; (3) external forces/drivers; (4) axes of uncertainty; (5) scenario writing; and (6) scenario implications.

Tourki et *al.*, [26] reviewed scenario analysis methods and its applications in engineering and environmental systems such as "Goods Producing" and "Service Providing" industries. They proposed a recommended process for scenario analysis through analysis, definitions, and evaluation as shown in Figure 1. Moreover, some researchers studied the inter-connectivity of the role of system thinking and scenario thinking in strategy supporting such as Powell [27] explored the coherence of system/scenario duality, and Torres et *al.*, [28] proposed a protocol for establishing strategy through system dynamics modeling. Lang and Ramirez [29] built a new social capital based on SP which address turbulence much faster that before. Sharma & Yang [30] proposed a hybrid SP framework for interactive digital media.

2.3. Business Model Canvas

Before the application of BMC was prevalent, two dominant BMC definitions existed. The first definition, which is presently the most commonly used by scholars and business managers, was derived from [31]. By synthesizing and comparing the most frequently used models and their components in earlier studies, Osterwalder et *al.*, [31] establish a nine building-block model comprising numerous components of business models mentioned by at least two authors. The nine blocks are as follows: (1) value proposition; (2) customer segments; (3) customer relationships; (4) channels; (5) key activities; (6) key resources; (7) key partners; (8) cost structure; and (9) revenue streams. They cover four main elements of a business: customers, offers, infrastructure, and financial viability. Osterwalder and

Pigneur [8] propose a more recent BMC definition: A BMC describes how an organization creates, delivers, and captures value. They also slightly revise the nine building blocks.

Several other scholars advocate for different perspectives on discovering business models. Twelve definitions in established publications dating from 1998 to 2002 are listed, with 42 components existing within the 12 definitions. Hence, an affinity diagram is proposed to categorize the business model components that are cited twice or more [32]. Four major categories are outlined: strategic choices, the value network, creating value, and capturing value. After these concepts are combined with the results summarized in the affinity diagram, business model is defined as a representation of a firm's underlying core logic and strategic choices for creating and capturing value within a value network.

For the past decade, especially the past 5 years, the BMC concept has become more prevalent resulting from scholars' consistent research and companies implementing business model concepts and techniques within their firms. This development is implied in the book Business Model Generation, which summarizes business models with similar characteristics and determines five related patterns based on sufficient past studies and cases. In addition to Gillette's bait and hook freemium pattern, other examples it demonstrates included LEGO's long tail pattern model, Xbox's multisided platforms model, and P&G's open business model. Moreover, Keane et *al.*, [33] analyzed the representation of nine elements of BMC from managers and entrepreneurs perspective and developed new nine efficacy variables to show how different managers and entrepreneurs are. Toro-Jarrin et *al.*, [34] build a methodology for integrating BMC and technological road-map.

2.4. Free Cash Flow to Equity Discount Model

Because disclosing free cash flow to the public is not required by US GAAP, scant theoretical and conceptual guidance exists on how to calculate it. However, two methods, the operations-based method and income-based method, exist. Among the samples of the free cash flow disclosures, 55.6% are determined using a cash flow from operating activities (CFO)-based method and 14.2% from an income-based method [35]. According to Adhikari & Duru [35], the operations-based method calculates free cash flow by adjusting the cash flow according to operations. The definitions of free cash flow are provided in equations (1)-(4).

$$Free\ Cash\ Flow = CFO\ -\ Capital\ Expenditures \tag{1}$$

$$\begin{aligned} Free\ Cash\ Flow = \ & CFO\ -\ Capital\ Expenditures\ -\ Depreciation \\ & \pm\ Change\ in\ Non-cash\ Working\ Capital \end{aligned} \tag{2}$$

$$\begin{aligned} Free\ Cash\ Flow\ = \ & CFO\ -\ Nonrecurring\ Charges \\ & -\ Maintenance\ Capital\ Expenditure \end{aligned} \tag{3}$$

$$Free\ Cash\ Flow\ =\ CFO\ -\ Investing\ Activities \tag{4}$$

The income-based method adjusts net income or earnings before interest, taxes, depreciation, and amortization (EBITDA) to replace the CFO and subsequently determines free

cash flow. For the income-based method, free cash flow derived from net income accounts for 80% of all the studied samples, and EBITDA accounts for 20%. For the operations-based method, the capital maintenance perspective and all-inclusive perspective exist. Over 50% of the firms using the operations-based method rely on the capital maintenance perspective because it conforms to The International Accounting Standards Board (IAS 7) [35]. For the capital maintenance method, free cash flow indicates, without reducing the value of the business, the amount of cash that owners can consume [36, 15]. Free cash flow is calculated as net CFO less the necessary capital expenditures for maintaining the future production of a business. Discretionary expenditures such as dividends, outlays for debt reduction, and stock repurchases are not considered. The capital maintenance method is also called the unlevered DCF approach: The enterprise value of a firm equals the present value of its expected free cash flow, where the appropriate free cash flow is calculated before the effect of leverage (meaning free cash flow has not been adjusted down for interest or principal payments). The cash flow represents both equity and debt holders and the discount rate reflects the cost of capital for both parties. For the all-inclusive perspective, debt payments and normal dividend payouts are deducted when calculating free cash flow because businesses have relatively little discretion in paying those expenses. The all-inclusive maintenance method is also called the levered DCF approach. For it, the interest expense, the interest tax shield, and principle payments are explicitly projected in the calculation of cash flow, which represents cash flow only regarding equity holders. Additionally, the discount rate reflects the cost of capital only regarding equity holders.

2.5. Constant Growth Free Cash Flow to Equity Model

The constant growth free cash flow to equity (FCFE) model is designed to valuate firms that reach a stable growth rate. The value of equity, under the constant growth model, is a function of the expected FCFE in the next period, the stable growth rate, and the required rate of return. When the capital maintenance method, or the unlevered DCF approach, is used, the weighted average cost of capital should be used (instead of cost of equity), reflecting the cost of debt and equity weighted by their respective proportions of the total capital invested in the enterprise. The constant growth FCFE model is outlined in equation (5). Equations (6)-(9) define the model's components.

$$Value = FCFE1/(WACC - g_n) \tag{5}$$

where

$$Value = Value\ of\ Stock\ Today \tag{6}$$

$$\begin{aligned} FCFE1 \ &= Expected\ FCFE\ Next\ Year \\ &= Expected\ FCF + Net\ borrowing \\ &\quad -Interest * (1 - Tax\ rate)\ of\ Next\ Year \end{aligned} \tag{7}$$

$$WACC = Weighted\ Average\ Cost\ of\ Capital \tag{8}$$

$$g_n = Permanent\ Growth\ Rate\ in\ FCFE\ for\ the\ Firm \quad (9)$$

The growth rate used in the model must be reasonable relative to the nominal growth rate of the economy in which the firm operates. Being conservative with the growth rate is ideal (Wall Street Prep, [37, 38]). Recent studies are more focused on exploring the specificity of business models. We do not know of any studies attempting to add either SP or the conventional valuation methods to the BMC to consider the future dynamic conditions and comprehend the BMC cost structure and revenue streams more explicitly.

3. Methods

This study analyzes a mobile application venture capital-based company, Company X. As Company X has a relatively short history and few volatile earnings. Furthermore, and crucially, analysts do not analyze any company like Company X, hence no relevant information is publicly available for investors. Company X's condition is compatible with the goal of this study is to valuate a company whose information is difficult to access publicly.

This study's main objective is to derive the target company's (Company X) ultimate BMCs and provide insights into and suggestions for the target company. The BMCs is determinable on the basis of the SWOT analyses and financial modeling/valuation results. The original BMC/SWOT analysis, which does not consider SP and financial modeling/valuation results, can be analyzed to contribute toward SP. The SP results account for time and future uncertainties and inform the required financial modeling/valuation assumptions for the future years. The SP results also affect the ultimate SWOT analyses results. After leveraging the SP results, the initial static financial modeling/valuation becomes dynamic.

3.1. Business Model Canvas

The BMC provided by Osterwalder & Pigneur, [8] is mature both in its concept and application. It is also commonly-used in the industry. This suits this study's goal of applying a mature and commonly-used commercial model to analyze Company X's status and strategy. Although studies have already performed sufficient additional research on this topic in the past 5 years, researchers tend to extend past business models' frameworks and adapt them to different specific disciplines of management science. We did not find any research combining original business models' frameworks with valuation techniques to provide a general method for analyzing start-up companies. By proposing our integrated model, this study contributes something novel to the related research. A SWOT analysis is embedded in the BMC to complement the initial analyzed BMC. This is in part to enable considering Company X's main competitor instead of simply inspecting Company X's internal situation alone.

3.2. Scenario Planning

SP can be appropriately combined with traditional static strategy decision-making approaches because it considers future uncertainties in a consistently evolving environment.

Using SP suits this research in two respects. First, BMC can be implemented to analyze Company X qualitatively, complimenting this study's goal of providing strategic suggestions/insights for Company X after combining both a qualitative and quantitative analysis. Leveraging SP boosts this study's qualitative analysis and improve the whole case analysis as well. Second, SP connects between commercial modeling and financial statement/valuation modeling. When implementing financial modeling/valuation, analysts are required to implement sensitivity/scenario analysis to exam how the results change when the most critical assumptions are altered. Sensitivity/scenario analysis makes financial modeling/valuation more comprehensive, realistic, and reliable. For this research, SP serves as a vital mechanism to change the range of possible scenarios (options) into a range of critical assumptions (objectives/attributes), which resembles the effects of a sensitivity/scenario analysis of financial modeling/valuation.

For our integrated model, key decision factors and external forces/drivers are determined based on BMC analysis, SWOT analysis, and massive literature reviews. This is similarly performed in [4]; however, a difference exists in the method Ahlstrand et *al.*, [4] reveals for implementing SP twice for SWOT analysis. By contrast, this research implements SP once for SWOT analysis. The reason for this is explained in the next paragraph.

For the integrated model, the axes of uncertainty is be determined by Company X's managers, who are experts in their industry. They determine the axes of uncertainties by using the impact-uncertainty matrix. The integrated model aims to determine two to three axes of uncertainty. For inspecting the scenario consistencies, the integrated model determines the four most relevant scenarios. This is because the related literature indicates that when more than four scenarios are discussed, irrelevant issues become considered. This research does not adopt the exact method discovered in Ahlstrand et *al.*, [4] because implementing SP two times for SWOT impedes decreasing the most pertinent scenarios to four or less.

The goal of the final step of SP is to provide strategy development in the scenario implication sector. We expand upon this sector by first determining the assumptions/drivers meant for use in financial modeling/valuation, then implementing financial modeling/valuation, and finally deriving the implications by combining the results from both SWOT analyses and financial modeling/valuation results. This step aligns with the approach of using decision analytic tools to add strategy development within scenario development, making it into SP. This case analysis uses a method similar to the value tree concept, and defines the options as the four different scenarios and attributes/objectives as the assumptions/drivers meant for use in financial modeling/valuation. The determination of these assumptions is first performed in reference to the prevalent conventional approaches/methods suggested by Wall Street Prep ([37, 38]), and is subsequently discussed with Company X's managers. A clear solution is be reached when the assumptions/drivers are leveraged to financial modeling/valuation because this enables scoring consequences on the given objectives/attributes from different options.

3.3. Financial Modeling and Valuation

This research implements Damodaran's [1] venture capital prediction model valuation method. Figure 2 illustrates an overview of how the financial components, which contribute

to the enterprise value, relate to each other. After we compare the methods provided in earlier research on the topic of valuating young start-up firms, the method suggested by Damodaran [1] was deemed the most comprehensive and reasonable. Damodaran [1] explicates steps for valuating firms with a short history and volatile earnings based on established and reviewed theories. Other methods proposed in journals are relatively new and their assumptions and results have not been sufficiently analyzed through case applications yet. Therefore, this research uses the valuation method framework and logic detailed in Damodaran [1]. By using the historical data provided by Company X and the assumptions determined in SP (Stanford Research Institute, 1996), this research employs Excel to determine an historical and projected income statement, balance sheet, and cash flow statement. This research attempts to determine all three financial statement models instead of merely certain total asset multiples or revenue multiples because Company X is not stable enough to calculate critical multiples. Furthermore, the prediction models used provide more accurate and precise results than does the use of multiples. Additionally, this research implements a simple approximate model, as is suggested in Cairns et *al.*, [39], because scant information is known about the current status of Company X and its industry is relatively novel. Thus, Company X's managers have scant information to base their judgments on. Doing so also enables this research to focus on key topics and avoid less relevant details.

To calculate free cash flow, this research implements an operations-based, capital maintenance definition of it. This is done because this definition is the most prevalently used within the relevant research and it complies with the International Accounting Standards Board (IAS 7) [35]. Thus, this research uses the unlevered free cash flow approach. Determining the interest expense, interest tax shield, and principle payments in each future year required when calculating levered free cash flow is difficult. This difficulty increases the likelihood of predicting a dubious equity value for Company X (Wall Street Prep, [37, 38]). Moreover, start-up companies are rarely financed through debt; venture capitalists are not motivated to invest in debt because it may be harmful to both the investors and the investees, causing a lose-lose consequence [40]. Therefore, because debts and interest expenses are not present in Company X's financial statements, the application of the proposed model uses the unlevered free cash flow method and calculates the enterprise value instead of the equity value. Free cash flow in this research is as defined in equation (1).

To determine Company X's terminal value at the end of the last projected year, the constant growth FCFE model is implemented. Again, the weighted average cost of capital is used instead of the cost of equity because we are using the unlevered free cash flow approach. The formula for this determination is provided in equation (5).

The three financial statements were projected after discussing the historical data and underlying assumptions with Company X's managers.

This research uses the capital asset pricing model (CAPM) among the three mean-variance models to measure market risks for two reasons. First, the CAPM is the longest-used risk and return model and is still the standard for most practitioners. Second, the CAPM is the simplest model among the three mean-variance models, only requiring one firm-specific input (Beta). For a venture capital-based start-up firm that provides no public information, using the asset pricing model or multifactor model adds complexity and

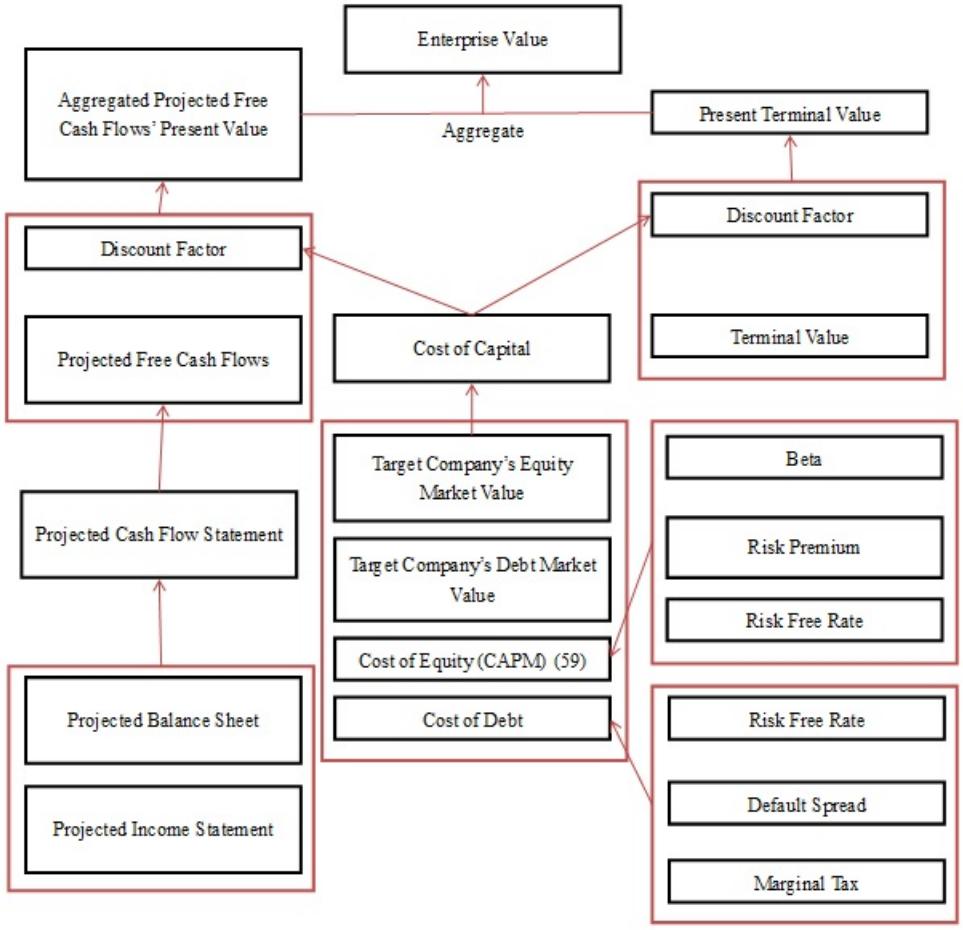

Figure 2: Damodaran's [1] Venture Capital Prediction Model Valuation Method

difficulty to the valuating process. Based on the CAPM, the expected rate of return that investors require on an equity investment in a firm is calculated, as shown in equation (10).

$$Expected\ Return = Risk - Free\ Rate + Beta(Risk\ Premium) \tag{10}$$

For determining the risk-free rate and risk premium, this research employs the conventional approach. The risk-free rate is assumed to reflect the average yield of Taiwan's 10-year treasury bond. The market risk premium is assumed to represent the average historical excess returns spread between the Taiwan Stock Exchange Weighted Index (TAIEX) and Taiwan's 10-year treasury bond. Historical risk-free rates and risk premiums were attempted to be accessed and available data was averaged to serve as Company X's risk-free rate and risk premium. To determine the weighted average cost of capital (WACC), in addition to calculating cost of equity, cost of debt must be determined. The proposed method determines Company X's cost of debt by asking Company X's manager to determine the credit spread rating Company X should have. This determines the default spread. The spread table is be provided by Reuters, and Company X's marginal tax rate for cost of debt

is its last projected year's effective tax rate because it is considered "marginal."

After combining the cost of equity derived from the CAPM and cost of debt, the WACC is determined as follows:

$$Cost\ of\ Capital = K_e[E/(E+D)] + K_d[D/(E+D)]. \tag{11}$$

The cost of capital is defined as the weighted average of each of the costs. In general, the cost comes from equity and debt.

The cost of equity (K_e) reflects the riskiness of the equity investment in the firm.

The after-tax cost of debt (K_d) is a function of the default risk of the firm. The weights of each of these components should reflect their market value proportions, since these proportions best measure how the existing firm is being financed.

Assume E and D represents the market values of the equity and debt, cost of capital can be illustrated in equation (11).

Company X's market value for debt and equity is also calculated as the market debt and equity values' average of the companies that Company X aims to become through development. This is because Company X's capital structure will likely resemble those developed companies' capital structures once it develops. Also, still being a start-up, Company X has little or no debt, which is likely to change as it develops.

For the CAPM, the Beta still requires consideration. For the Beta, because Company X is a start-up firm, the proposed integrated method uses the bottom-up beta approach (fundamental beta) to calculate it. After Company X's managers determine the main publicly traded companies that Company X aims to become as it develops, the proposed method is able to determine Company X's Beta.

3.4. Discussions and Implications

This step leads the whole case study back to its first step: the BMC. By leveraging the quantitative results gained from financial modeling/valuation, the proposed integrated model combines the metrics with SWOT analyses (the qualitative part) to gain comprehensive and in-depth insights. The entire case study is thus be more integrated, comprehensive, and more reliable. The implications are determined and discussed along with the four derived scenarios.

4. Case Study and Results

4.1. BMC and SWOT Analysis

Company X was originally a domestic automobile fleet management telematics designing/manufacturing company. In June 2013, Company X shifted toward mobile app development, transitioning itself to provide both hardware and software services. Company X then developed an automobile-related mobile app, which is relevant to the industry that Company X is most experienced in. This mobile app's target users are prospective buyers of automobiles as well as those simply interested in automobiles. This app is currently the most complete automobile platform in Taiwan. Inspired by this success, Company X decided

<table>
<tr>
<td rowspan="2">Key Partners
● Cooperation with Google Analytics (Strength)
● Make the most of key partners (Strength)
● Only two substantial partners (Weakness)
● Cooperate with main competitor (Opportunity)
● Dependent on partners and vulnerable to their betrayal (Threat)</td>
<td>Key Activities
● Fewer resources for each key activity (Weakness)
● Key activities easily replicated (Threat)</td>
<td rowspan="2">Value Propositions
● Proven successful app framework (Strength)
● Low cost (Strength)
● Exclusive value provided (Strength)
● Big data–based feature (Strength)
● Low reputation (Weakness)
● Fewer features provided (Weakness)
● Merge with other companies to provide additional value (Opportunity)
● Gain reputation (Opportunity)
● Competitor provides same value (Threat)
● Competitor lowers prices (Threat)
● Competitor provides big data–based feature (Threat)</td>
<td>Customer Relationships</td>
<td rowspan="2">Customer Segments
● Customers well-segmented (Strength)
● Few existing customer segments (Weakness)
● Few categories exploited in the targeted customer segment (Weakness)
● Expand customer segments (Opportunity)
● Existing customers' betrayal (Threat)
● High barrier in expanding customer segments (Threat)</td>
</tr>
<tr>
<td>Key Resources
● Makes the most of key resources (Strength)
● Limited resources (Weakness)
● Receives additional funds (Opportunity)
● Sudden loss of existing resources (Threat)
● Key resources easily replicated (Threat)</td>
<td>Channels
● Direct and straightforward (Strength)
● Weak sales force and website (Weakness)
● Few channels (Weakness)
● Strengthen existing channels (Opportunity)</td>
</tr>
<tr>
<td colspan="3">Cost Structure
● No economies of scale (Weakness)
● Merge with other larger companies for economies of scale (Opportunity)
● Cost controlled by external partners (Threat)</td>
<td colspan="3">Revenue Streams
● Few and inconsistent revenue streams (Weakness)
● Low profit margins (Weakness)
● Add revenue streams (Opportunity)
● Consistent revenue streams (Opportunity)
● Improve profit margins (Opportunity)
● Unable to gain future consistent revenue streams (Threat)</td>
</tr>
</table>

Figure 3: Company X's SWOT Analysis

to leverage and expand its already-developed app's framework and launch another business. Company X realized that it could add value to any participants in the publication industry by providing them with the app framework along with additional management functions of the publishers' design. The publisher would only be required to follow the provided instructions and input any contexts they sought to publish into this framework/platform. The publishers would then have their own publication apps. The service primarily exists in the ad hoc and dynamic cloud environment. The sustainable collaboration of technology service requires appropriate value allocation. Its e-commerce supply chain cost evaluation also requires comprehensive calculation.

Company X is a third-party app developer that helps its clients build their own apps. In this study, we consider 91APP to be Company X's main competitor. The company 91APP is currently Taiwan's most powerful m-commerce service provider, providing revolutionary mobile business solutions with existing and potential retail brands. At low costs, 91APP clients can own independent iOS/Android apps and responsive web design websites to boost their sales performances. Figures 1 to 3 demonstrate Company X's SWOT analysis based on a comparison between Company X and 91APP performed using BMC as a framework. This comparison is performed before combines the results of SP and financial modeling/valuation.

Table 1: Consistent and Rational Scenarios Summary

	Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**
Name	Growing Shark in a Stagnated Pond	Good as it Gets	Crippled Hunter in the Amazon	Sunset before Darkness
Customer Segments	Expanded	Expanded	Not Expanded	Not Expanded
Less Popular Categories	Exploited	Exploited	Not Exploited	Not Exploited
Third-Party App Market Competition/Failure Rate	Low	High	High	Low

4.2. Scenario Planning

This study's SP goal is to determine the most crucial external drivers that must be addressed to survive and prosper in the uncertain and competitive third-party mobile app developer environment. Based on the most pertinent external drivers determined, assumption parameters for Company X's financial projections are reasonably determined and future scenario implications are subsequently derived by combining SP, financial modeling/valuation, and BMC results. By using this principle to serve the focus/decision area and the proposed method described in the previous chapter, this thesis derived four scenarios, listed in Table 1.

The SWOT analysis is then revised based on the new information and conclusions gained from SP. Note that "Growing Shark in a Stagnated Pond" and "Good as it Gets" share the same SWOT analysis (Figure 4), as well as do "Crippled Hunter in the Amazon" and "Sunset before Darkness" (Figure 5).

4.3. Financial Modeling and Valuation

Through use of the proposed method and aforementioned steps, the projected financial statements and enterprise values are calculated separately and summarized in Table 2. Such data can be generated using the proposed integrated model to determine how key financial statements such as an income statement, balance sheet, cash flow statement, and enterprise value and ratios will behave under various scenarios. The scenario analysis combined with future financial statements can help practitioners valuate a start-up company under different situational considerations.

5. Conclusion

This research integrated BMC, SP, and the conventional prediction model valuation method. Earlier studies have attempted integrating SP with traditional strategy decision-making approaches. However, no study has combined SP with the conventional prediction model valuation method (i.e. the NPV method). The current research provides a basis for others to expand the uses of SP. It also provides a novel process by combining SP and financial modeling/valuation with the original BMC, therefore considering time and future uncertainties and strengthening the cost structure and revenue streams.

Because the BMC prevalently used in the industry have always been changing, this research employs Osterwalder and Pigneur's [8] BMC to perform qualitative analysis. However, whether this BMC remains the ideal candidate for analysis in the future is uncertain.

<table>
<tr>
<td rowspan="2">Key Partners
● Cooperation with Google Analytics (Strength)
● Make the most of key partners (Strength)
● Outsourcing partners are few but critical (Weakness)
● Cooperate with main competitor (Opportunity)
● Dependent on partners and vulnerable to their betrayal (Threat)</td>
<td>Key Activities
● Few resources for each key activity (Weakness)
● Key activities are easily replicated (Threat)</td>
<td rowspan="2">Value Propositions
● Proven successful app framework (Strength)
● Low cost (Strength)
● Exclusive value provided (Strength)
● Big data–based feature (Strength)
● Poor reputation (Weakness)
● Few features provided (Weakness)
● Merge with other companies to provide more value (Opportunity)
● Gain reputation (Opportunity)
● Competitor provides same value (Threat)
● Competitor lowers price (Threat)
● Competitor provides big data–based feature (Threat)</td>
<td>Customer Relationships</td>
<td rowspan="2">Customer Segments
● Customers well-segmented (Strength)
● Customer segments expanded (Strength)
● Few categories exploited in the targeted customer segment (Weakness)
● Loss of existing customers(Threat)</td>
</tr>
<tr>
<td>Key Resources
● Make the most of key resources (Strength)
● Limited resources (Weakness)
● Receive additional funds (Opportunity)
● Sudden loss of existing resources (Threat)
● Key resources easily replicated (Threat)</td>
<td>Channels
● Direct and straightforward (Strength)
● Weak sales force and website (Weakness)
● Few channels (Weakness)
● Strengthen existing channels (Opportunity)</td>
</tr>
<tr>
<td colspan="3">Cost Structure
● No economies of scale (Weakness)
● Merge with other larger companies for economies of scale (Opportunity)
● Cost controlled by external partners (Threat)</td>
<td colspan="3">Revenue Streams
● Numerous and consistent revenue streams (Strength)
● Low profit margins (Weakness)
● Improve profit margins (Opportunity)</td>
</tr>
</table>

Figure 4: SWOT Analysis for "Good as it Gets" and "Growing Shark in a Stagnated Pond"

In reality, venture capitalists tend to valuate start-up companies by using total asset or revenue multiples, as demonstrated in [1]. Because of time limits, this research is unable to perform multiple analysis and compare the results. Because of limited resources, this research uses the CAPM to serve as the mean-variance model for measuring risk. However, if the arbitrage pricing model or multifactor model could somehow be employed, the research results may be more certain. This research averaged the past 10 years of Taiwanese 10-year treasury bond yields to represent the risk-free rate and averaged the past 10 years of excess return spreads between the TAIEX and the risk-free rates to represent the risk premium. If more previous years' data could be accessed, the valuation would be more precise.

If future research evaluates a target company by using total asset and revenue multiples and then compares the results to those in this research it would provide additional information. A comparison of the methods and results can be another subject for research. Because this research is a case analysis and forecasts a target company's future cash flow, future research should determine how the target company eventually performs and how the facts deviated from this research's predictions and why. The most prevalently used BMC within an industry has always changed and original BMC are consistently evolved. Therefore, future scholars should also keep up-to-date on to the current BMC.

<table>
<tr>
<td>Key Partners
● Cooperation with Google Analytics (Strength)
● Make the most of key partners (Strength)
● Only two substantial partners (Weakness)
● Cooperate with main competitor (Opportunity)
● Dependent on partners and vulnerable to their betrayal (Threat)</td>
<td>Key Activities
● Few resources on each key activity (Weakness)
● Key activities easily replicated (Threat)

Key Resources
● Make the most of key resources (Strength)
● Limited resources (Weakness)
● Receive additional funds (Opportunity)
● Sudden loss of existing resources (Threat)
● Key resources easily replicated (Threat)</td>
<td>Value Propositions
● Proven successful app framework (Strength)
● Low cost (Strength)
● Exclusive value provided (Strength)
● Big data–based feature (Strength)
● Poor reputation (Weakness)
● Few features provided (Weakness)
● Merge with other companies to provide more value (Opportunity)
● Gain reputation (Opportunity)
● Competitor provides same value (Threat)
● Competitor lowers price (Threat)
● Competitor provides big data–based feature (Threat)</td>
<td>Customer Relationships

Channels
● Direct and straightforward (Strength)
● Weak sales force and website (Weakness)
● Few channels (Weakness)
● Strengthen existing channels (Opportunity)</td>
<td>Customer Segments
● Customers well-segmented (Strength)
● Few existing customer segments (Weakness)
● Few categories exploited in the targeted customer segment (Weakness)
● Expand customer segments (Opportunity)
● Loss of existing customers (Threat)
● Large barrier in expanding customer segments (Threat)</td>
</tr>
<tr>
<td colspan="3">Cost Structure
● No economies of scale (Weakness)
● Merge with other larger companies for economies of scale (Opportunity)
● Cost controlled by external partners (Threat)</td>
<td colspan="2">Revenue Streams
● Few and inconsistent revenue streams (Weakness)
● Low profit margins (Weakness)
● Add revenue streams (Opportunity)
● Consistent revenue streams (Opportunity)
● Improve profit margins (Opportunity)
● Unable to gain future consistent revenue streams (Threat)</td>
</tr>
</table>

Figure 5: SWOT Analysis for "Crippled Hunter in the Amazon" and "Sunset before Darkness"

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Table 2: Comparison of Four Possible Financial Statuses

Index	Good as it Gets	Growing Shark in a Stagnated Pond	Crippled Hunter in the Amazon	Sunset before Darkness
Income Statement				
Total SG&A / Total Revenue (2017)	44.1%	88.2%	5.5%	11.0%
Net Income / Total Revenue (2017)	46.4%	9.8%	78.4%	73.9%
Balance Sheet				
Cash & Equivalents / Total Assets (2017)	88.5%	69.4%	85.4%	72.2%
Accounts Payable / Total Assets (2017)	22.3%	59.2%	2.2%	4.1%
Accrued Expenses / Total Assets (2017)	6.8%	18.1%	0.7%	1.3%
Additional Financed Capital (2017)	68,855	127,355	142,750	298,375
Total Liabilities / Total Assets (2017)	29.5%	78.9%	4.9%	12.7%
Retained Earnings to Total Assets (2017)	63.0%	1.2%	71.6%	42.7%
Stockholders' Equity / Total Asset (2017)	70.5%	21.1%	95.1%	87.3%
Total Asset Growth Rate (2017)	267.2%	229.1%	221.8%	160.3%
Cash Flow Statement				
CFO (2017)	17,872,628	5,588,628	5,805,020	2,734,020
CFF (Max)	68,855	127,355	142,750	157,375
Year(s) CFF >0	1	1	1	2
Total Increase of Cash (2017)	17,872,628	5,588,628	5,805,020	2,734,020
Enterprise Value and Ratios				
Estimated Enterprise Value	1,352,640,870	422,326,244	438,704,940	206,115,453
Additional Financed Capital / Stockholder's Equity (Max)	7.8%	23.7%	17.3%	44.6%
Year Total Revenue >Total Assets	2016	2016	x	x

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