DESIGN DRIVEN STARTUPS

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Abstract

This paper explores how market, technology and design execution risks influence a startups' performance. First, we uncover relationships between market and technology risk and the startups' success, as defined by their ability to receive financing and be acquired. We then establish unique opportunity areas for startups, based on a capital framework perspective. To assess a startup's design execution performance, in a selected market - technology position, we then develop a multi-variable linear prediction model of the startup's design execution, assessing risk based on data from previously conducted studies of eighteen design teams. Finally, we test the model's predictive power on a second set of previously conducted studies of thirteen design projects. The design driven startup predictive model can be applied to evaluating the strength of business opportunities of startup entrepreneurial ventures in the "seed stage" of Angel and Venture Capital investors' selection and financing funnel process. In conclusion, we outline opportunities for implementing the model in a double-sided online business model to collect further evidence for the model's predictive capabilities across industries.

Keywords: Entrepreneurship, Success metrics, Prediction model, Design Driven, Decision making

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1 INTRODUCTION

Western economies are predicted to stagnate for the foreseeable future (Piketty, 2013) and established firms' growth has stalled and continues to discard employees to barely remain profitable. Small and medium size firms are now responsible for the majority of the growth in the USA (SBA 2012, GEM 2013) and entrepreneurship is generally considered the last bastion of progress.

In this setting, however, as with the past three centuries of economists' doom and gloom predictions, the contribution to growth from innovation may now be especially underestimated. Increased global connectivity, instant feedback, online access to global markets and lower cost of Information Technology (IT), has resulted in democratization of investments, design, manufacturing and distribution (Friedman 2008), leading to a diminished importance of Financial Capital. However, Human Capital, especially managerial and Creative Capital has exploded in value, with the worth of Social Capital now reaching an all time high (Burt 1995). We may even be in the middle of a "startup bubble" (Kelley 2014).

In stark contrast to previous decades, starting a venture can be accomplished on a shoestring budget due to the low cost of information and tools in combination with the high value of skills that founders bring to the equation. Bootstrapping is now often possible up to Round A Financing, where capital is required for marketing to scale rapidly, as well as, New Product Development (NPD) to deliver high quality offerings (Blank 2012).

Consequently, while in the past founders had to relinquish control of their venture (more than seventy to eighty percent equity) by the time of their Initial Public Offering (IPO), they can now often limit the dilution of their stock by building significant "sweat equity" up until the Seed Stage (Robbins 2003). With the admission price of startups being significantly lowered and founders' value capturing increased, risk-management and execution excellence remains the most critical components of managing a startup as well as an investors' portfolio of startups. This paper makes a contribution by proposing a four-prong decision-support process for the investment decisions of the Seed Early Stage: Bridging Business & Design Model (version 2.0), Market - Technology Risk Matrix, Capital Model and Business Opportunity Strength. See Figure 1.

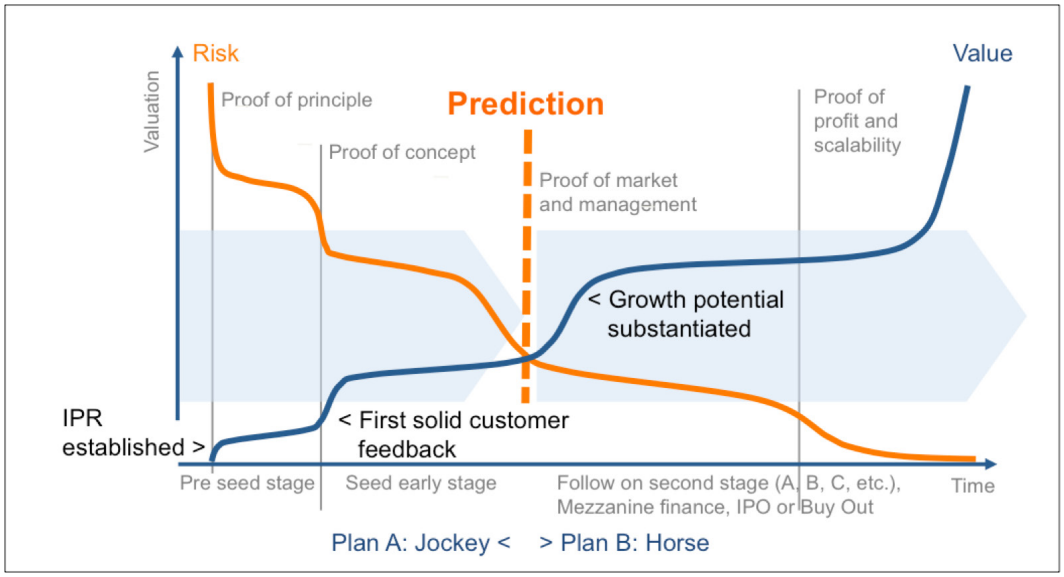

Figure 1. Startup risk and value over the business development cycle: At the beginning (pre seed and seed) formation of the team ("Jockey") is all-important. When a well functioning team has emerged, the plan ("Horse") overtakes as the most important element (follow-on stages) (Kaplan 2005). As the steps of the venture development result in proof of principle, concept, market and management, as well as, proof of profit and scalability, the value of the venture grows and the risk decreases (Heebøll 2008).

Strategic decision-support tools are abundant for established firms, dominated by the universally applied business assessment tool Strength - Weakness - Opportunity - Strength analysis (SWOT Analysis) (Humphrey 2005), competitor analysis dominated by Porter's Five Forces (Porter 1980), strategic positioning analysis customarily applying the Environmental Strategy analysis (Reeves and Tillmanns 2012) and innovation methods frequently applying the Blue Ocean strategy (Kim and Mauborgne 2005). However, methods for translating strategy into actionable criterion and solutions are far in between and of a magnitude fewer than methods for strategy development (Sull, Homkess and Sull 2015). The most commonly applied is the Balanced Scorecard method (Kaplan and Norton 1996). Even in successful established corporations, strategy is communicated successfully to the frontline in merely sixteen percent of the cases (Sull, Homkess and Sull 2015). When it comes to the unique requirements of startups, with the essential need to develop breakthrough innovations, even fewer methods are available. One of these being the recent developed Bridging Business Design (Petersen 2013) consisting of aligning competitive advantages with market needs (Afuah 2003), Business Model Canvas (Osterwalder and Pigneur 2010) and Inspirational Design Briefing (Petersen 2010) for translating business model elements into actionable Design Quality Criteria (Petersen 2009). For mapping relationships between key elements, the method applies Bridging Business & Design Model (version 2.0.) as described in this paper that tracks objective and metrics Managing Design Driven Innovation through the use of Design Scorecards (Petersen, Mozota and Kim 2015).

In part due to the protracted adoption process of new analysis methods, startups continue to fail at an alarming rate. Of the firms obtaining first time Venture Capital (VC) financing, only eighteen percent succeed. If the entrepreneurs secure VC financing for a second startup, then their success-rate increases by only two percent, or, to twenty percent if they failed the first time, increasing to a thirty percent success-rate if they succeeded the first time around (Gompers 2006). Mitigating the inherent risk in new ventures, a funding process has emerged where typically personal savings and Family, Fools and Friends (FFF) fund the Pre-seed Stage, Angel Investors Seed Early Stage and VCs participate in the Follow-on Second Stages (Markova 2009). This funding stage-gate process filters ventures from a magnitude a thousand in pre-seed to about twenty in seed, to around five in the follow-on stages (Heebøll 2014). The expected outcome is one venture with "hockey-stick growth" (displaying twelve to twenty times return on investment or potentially more) and four with linear growth (providing in the order of four times return on investment.) (Brown and Eisenhardt 1998 & Heebøll 2014). See Figure 2. Observe that design has a major influence on establishing the proof of principle, concept and market, making design a particularly essential part of a startup's early phase value creation, risk reduction and ultimately its success.

Even with a well established process for developing ventures, the overall profitability of venture investments perform worse than the NASDAQ Index (Masona 2002). The top ten reasons for the high failure rate of startups are: (Harvard Entrepreneurships 2014):

1. No Written Plan (design significant)
2. No Revenue
3. Business Opportunities Limited (design significant)
4. Unable to Execute (design significant)
5. Competition Too Tough
6. No Intellectual Property (design significant)
7. Inexperienced Team (design significant)
8. Resource Requirements Underestimated (design significant)
9. Small Marketing (design significant)
10. Giving In Early

Of these causes, seven (1, 3, 4, 6, 7, 8 and 9) are directly influenced by the startups design capabilities. Design has been proven to add considerable value to existing firms (Petersen 2007 and National Agency for Enterprise & Housing 2008) and would be expected to provide an even better result for startups embracing a design-centric approach at the outset. With design already being an intricate part of startups success in obtaining funding and executing (Gross 2014) we expect design drivers, such as the Design Quality Criteria (DQC) to be potential early predictors for startups success (Petersen 2009).

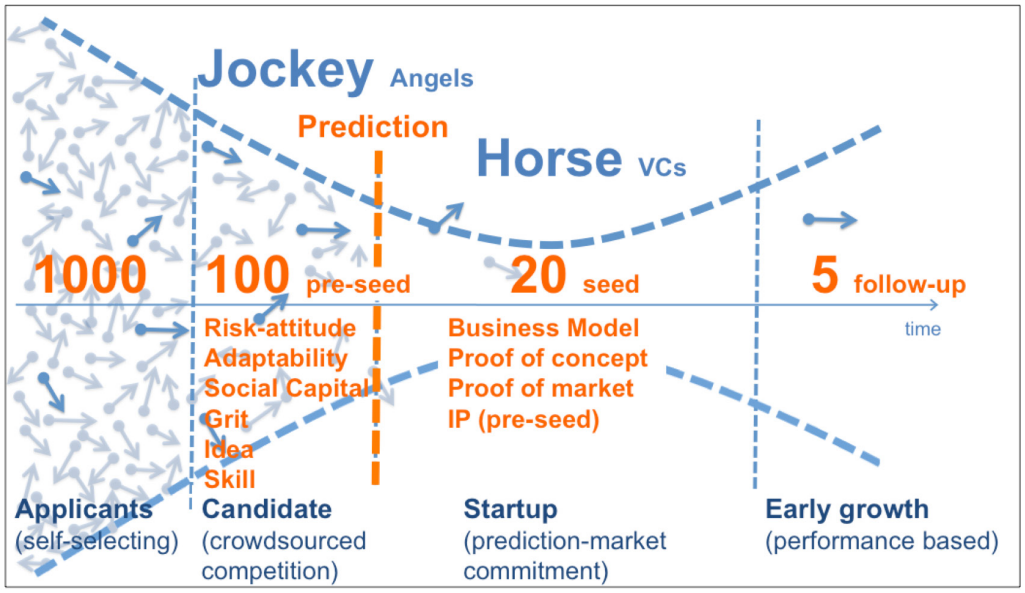

Figure 2. Startup selection-process. At the first filter, applicants are sorted based on a questionnaire and/or business plan/business model. In the second filtering, the characteristics of the team are assessed according to: Strength of ideas (including proof of principle), risk-attitude, adaptability, Social Capital, grit and relevant skills. The third filtering assesses the business model, proof of concept, market and intellectual property (IP). The following filters focus the ventures ability to deliver on financial metrics such as: Growth in sales, revenue growth, cash flow, customer acquisition costs, customer retention, customer attrition, Life Time Value of customer as well as new introductions and updates.

Reason (2) "No Revenue," is a consequence of the other reasons. Reason (5), "Competition Too Tough," is a consequence of the selected positioning in the Market and Technology Risk Matrix. The reason (10), "Giving In Early," is a characteristic of the founders. Therefore, we decided to limit our explorative study to market, technology and design execution risk, leaving out the non-design related characteristics of the founding team and business idea.

2 RESEARCH PROCEDURE

All business opportunities match an organization's capabilities with a market need to develop an offering that creates and captures value. Thus, it is imperative for a business opportunity's success that it aligns Organizational Capabilities with user needs (Afuah 2003). One of the challenges in accomplishing this is managing the key elements of each stage, while not mixing up early strategic elements with lesser important detailing elements and/or element in consecutive stages. We address this by introducing three concepts: Bridging Business & Design Model, Market - Technology Risk Matrix and Capital Model.

2.1 Bridging Business & Design

To manage the key elements in this process we apply the Bridging Business & Design (version 2.0.) (Petersen 2013a), which links Organizational Capabilities (Afuah 2003) to business model experimentation (Petersen 2013b), Inspirational Design Briefing (Petersen 2010) and then an iterative execution. See Figure 3.

2.1.1 Organization

First step, in the process of Bridging Business & Design, is connecting the four key elements of Organizational Capabilities (Culture, Organizational Architecture, Routines and Assets) to the Business Model Canvas elements for the new endeavour. The better the alignment here, the more profitable the business opportunity becomes.

2.1.2 Business Model

Second, the Business Model Canvas' nine elements: Customers, Customer Relationship, Delivery Chanel, Value Proposition, Key Activities, Key Resources, Partners, Revenue Generation and Cost Structure, have to be connected with the Inspirational Design Brief. If the business model is not communicated effectively to the design team, executing even the best plan will most likely fail.

2.1.3 Design Brief

Third, the Inspirational Design Brief's nine Design Quality Criteria: Strategy (Design Philosophy, Supply Chain Structure and Innovation level), Context (Social/human, Environmental and Viability) and Execution (Process, Function and Expression) have to be expressed so that the creative team can synthesize concepts of Minimal Viable Products, which can then be quickly prototyped, tested to providing a learning feed back loop to the team for the next iteration.

2.1.4 Execution

Fourth, the Inspirational Design Brief informs the design team about the requirements for the conceptual phase. Together with the team's personal and professional knowledge and their experience, this provides the inspiration for concept synthesis. Design can support NPD on four levels. Step one, by differentiating offerings, two - by streamlining the process, three - creating unique internal and external configurations and four - assisting in the creation of actionable strategies (Mozota 2006).

An example of a "road most travelled" is "Design as Differentiator" (approximately eighty to ninety percent of new products are positioned here) (Brown and Eisenhardt 1998). The organization is locating assets to formulate a new Value Proposition (VP), then relaying the required new Function and Expression of the offering to the design team and having it primarily focus on building, testing and learning. See Figure 3.

An example of a "road least travelled" is "Design as Strategy." Here, the organization is matching its unique culture with a specific customer segment, then relaying the desired new Social/human values and Expression of the offering to the design team and having them focus mainly on learning from these targeted users. See Figure 3.

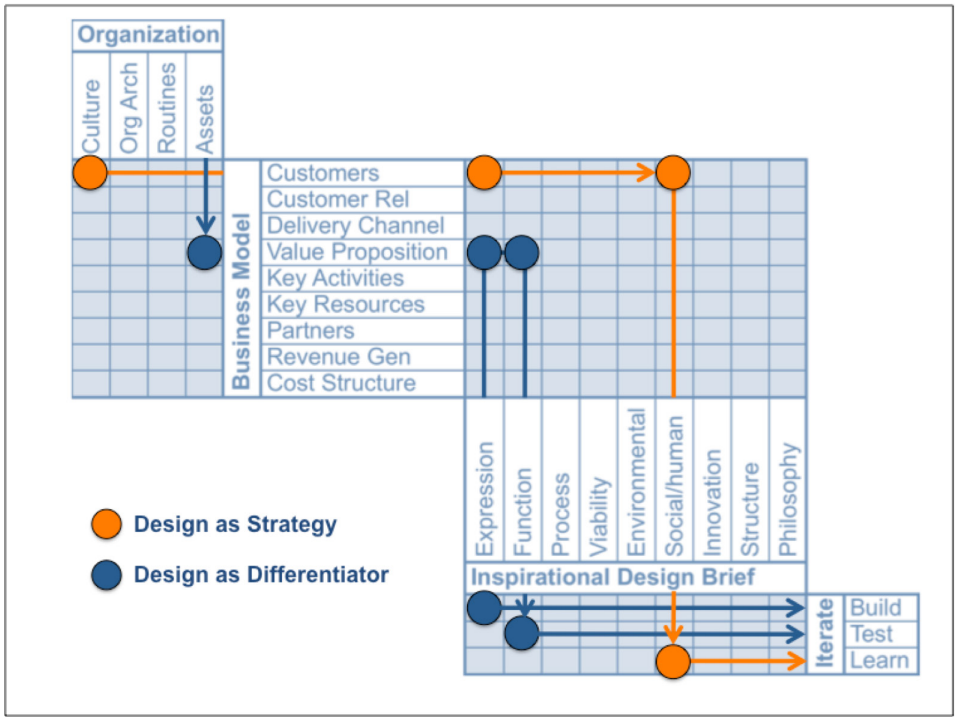

Figure 3. Bridging Business & Design Model (version 2.0.) The model addresses the following four elements: Organization, Business Model, Inspirational Design Brief and Execution

In this study, we leave organization out (non-design characteristics of the founding team), focusing on positioning and execution applying design to formulate business model, Inspirational Design Brief and iterate Minimal Variable Products (MVP).

2.2 Market - Technology Risk Matrix

The map selected for navigating the innovation space is the enhanced Market Technology Risk Matrix based on the Systematic Product Search approach (Nielsen 1989), which we have segmented into three zones: Red Ocean, Maverick Shore and Kamikaze Country. Red Ocean - located in the lower left corner of the matrix (Kim and Mauborgne 2005), constitutes the traditional area for NPD, targeting late majority and laggards (Moore 2002) with thirty to forty percent failure rate, down-spiralling profit margins and few larger incumbents (Cooper 2001). Kamikaze Country - located in the upper right corner of the matrix, coined by the author, constituted an area where breakthrough innovation take place by innovators followed by early adopters (Moore 2002) with ninety-five percent failure rate. Here, only Angel investors and FFF are prepared to invest. Maverick shore (a surf break by Half-moon Bay), coined by the author, constitutes a turbulent area in between Red Ocean and Kamikaze Country, where new markets of innovators and early adopters develop and grow, moving into early majority (Moore 2002). Here, rapid growth occurs followed by bubbles of over valuation / oversupply / over investment leading to consolidation. The risk here ranges from a forty to ninety-five percent failure rate. See Figure 4.

Each area requires its own strategy. Red Ocean focuses on differentiation of Performance and Expression. Kamikaze Country address innovation and Social/human criteria, leveraging technologies across new user activities and Maverick Shore balances these two areas.

2.3. Capital Model

There are three main types of capital important to the success of a startup: Financial Capital, Human Capital and Social Capital. Financial Capital is abundant and cheap today and, along with global connectivity, Human Capital has become easily accessible and is inexpensive as well. On the other hand, Social Capital is difficult and time consuming to acquire and manage (Burt 1995). As consulting experts in the field of startups and NPD, we have devised the following four zones in the Market - Technology Risk Matrix.

The upper level of technology risk, where new technology is developed, requires vast Financial, Human as well as Social Capital to succeed. This area is occupied by incumbents and is an almost impossible area for startups in which to compete.

The left area, addressing recognized need, requires vast Financial Capital and is also an area where incumbents thrive. Huge investments in marketing and incremental development of well-established brands and products make this area nearly impossible for startups to penetrate.

The area defined by Realizing Needs; combined with applying current or New Technology, requires Human Capital and Social Capital. This area is less attractive to incumbents firms, since the payback time on investments is long, resulting in a low Net Present Value (NPV). What prevents startups from mining this area is the time-horizon as well, together with the need for Social Capital, something a small entrepreneurial team is unlikely to possess.

This leaves the area of Clarifying Needs and Current Technology or applying New Technology. Here, incumbents will often mine Clarifying Needs and Current Technology when looking for relatively quick market expansions, however the area of Clarifying Needs and applying New Technology can be lucrative for startups, if they possesses the unique Human Capital for mining a specific market segment and technical skills for implementation. See Figure 4.

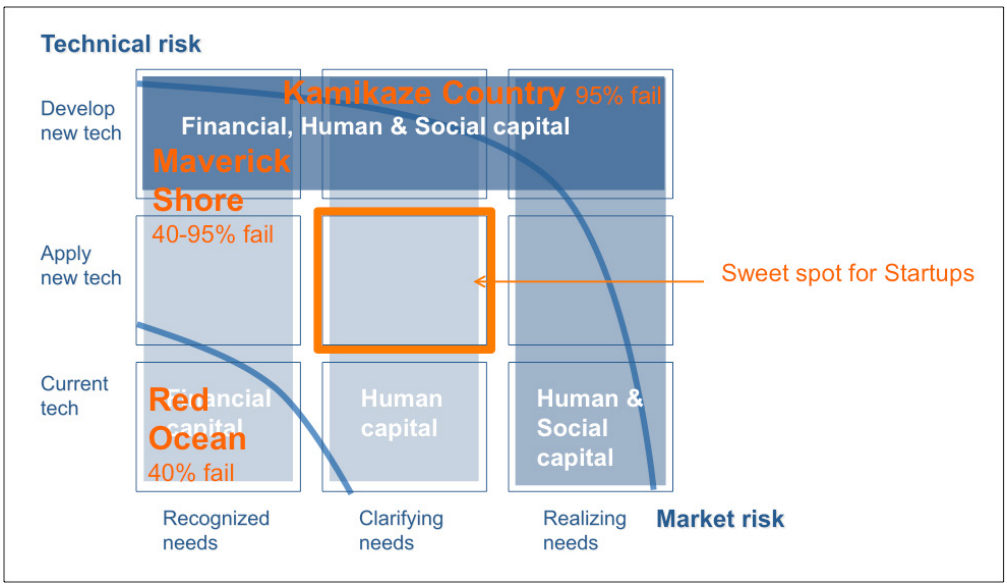

Figure 4. Market - Technology Risk Matrix and fit with Financial, Human and Social Capital

2.4. Data collection

To evaluate the influence of market and technology risk, we studied startup companies in operation. During the summer of 2014, we collected data on sixty-one startups, half from Silicon Valley (through Stanford) and the other half from San Gabriel Valley (though Innovate Pasadena). The startups were positioned in the Market - Technology Risk Matrix and coded according to their success as measured by whether they had been acquired, obtained seed financing or were operating without obtaining financing. The analysis confirmed that the area Clarifying Need - applying New Technology was indeed the most sought after area and also had a significantly higher success rate, sixty-seven percent, in regards to being funded or acquired by a large competitor. See Figure 5.

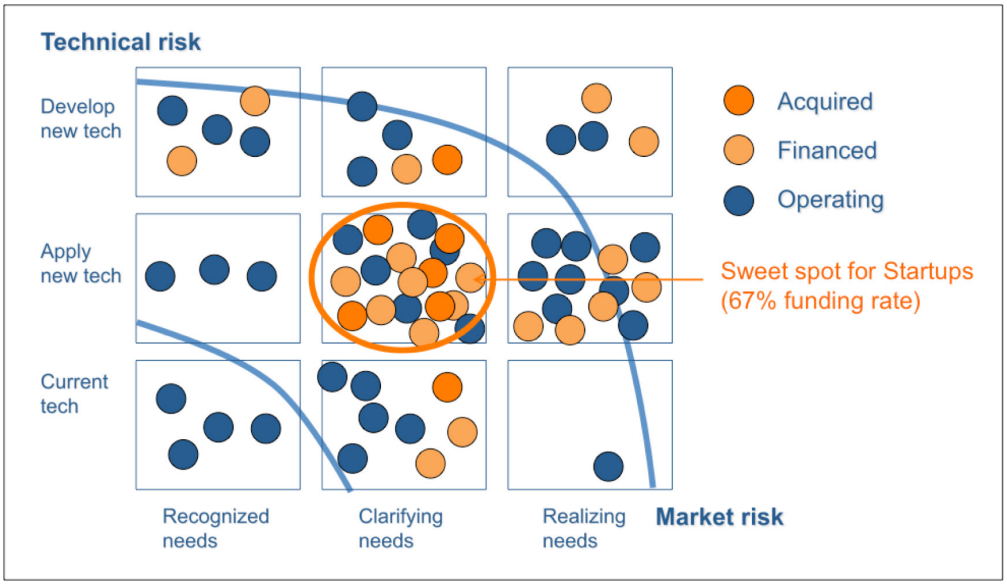

Figure 5. Market - Technology Risk Matrix and Sweet Spot for startups

2.5 Design Execution performance

To evaluate the influence of Design Execution on startup performance, we examined previous studies of the performance of NPD teams at Hanyang University, Seoul South Korea, and California State University, Long Beach, California, conducted in 2013. Both data sets had a good match in the Market - Technology Risk Matrix with the observed startups and we therefore expected these to provide a good approximation of startup teams' performance in the sweet spot area. See Figure 5 and 6.

Since the first study of Hanyang University Graduate and Undergraduate students applied the Bridging Business & Design Method, we deemed these most appropriate as a basis for a prediction mode.

Performing a Multi Variable Linear Regression Analysis, using SPSS, we located three parameters, which had a statistic significant influence on the outcome (better than $p<0.05$, $n=18$). These were Design Philosophy (Phil) and Expression (Exp), as evaluated by an external panel on a Likert scale from one to five as well as Technology Risk (Tech), as evaluated by the teams on a scale from zero to hundred percent risks. Together these three parameters accounted for sixty-five percent of the performance prediction, as evaluated by an overall evaluation by experts of the teams' business presentation. The presentation described the teams' business opportunities, supported by a design concept. The resulting prediction was:

Business Opportunity Strength (BOS) = + 0.5 x Philosophy (Phil) + 0.1 x Expression (Exp)
- 1.1 x Technology Risk (Tech) + 1.7 (constant)

Examining the internal prediction power we calculated the Person correlation between the actual performance as judged by the external panel and the prediction where we found corr = 0.836, $p<0.01$, $n=18$, using SPSS.

To evaluate the general applicability of the linear regressions prediction power, we applied it to undergraduate design student projects at California State University, Long Beach. We found the person correlation between predicted performance and actual perform to be corr = 0.875, $p<0.01$, $n=22$. This support the notion that the model can be applied cross cultures and creative professions in NPD and that the predictive power of our Multi Variable Linear Regression Model is generally reliable within ninety-three percent.

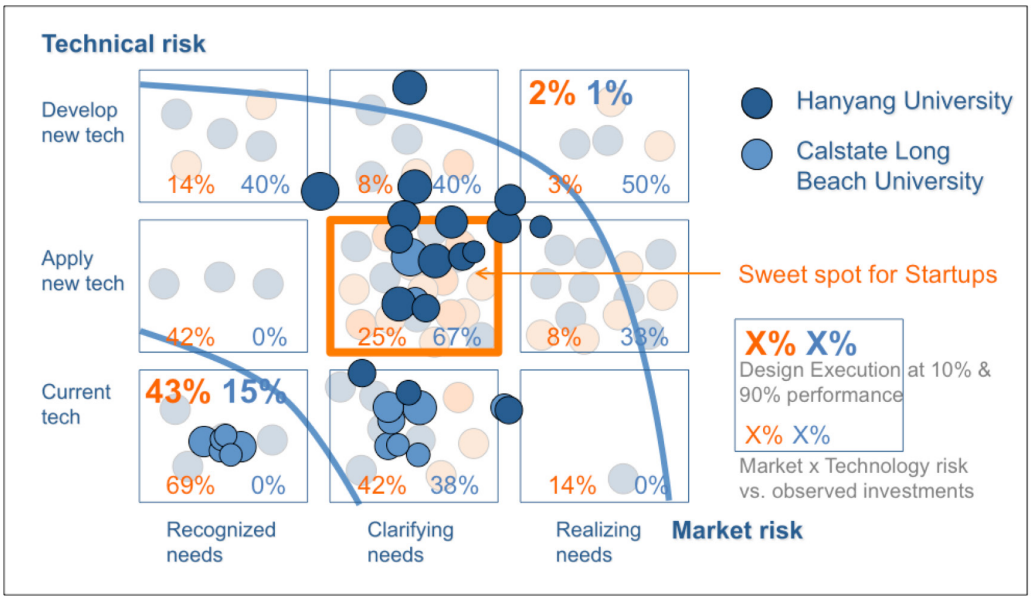

Figure 6. Market - Technology - Execution Risk Matrix and team execution performance

2.6 Prediction Model for Startup success

The current experts' selection process of twenty percent of candidates predicts startup success at up to thirty percent for founding teams with proven success. The proposed four-step model aids investors and startups alike by evaluating potential startup opportunities regarding (1) Bridging Business and Design (2) Positioning (Market - Technology Risk Matrix), (3) Capital fit (Financial, Human and Social Capital) and (4) the probability of success by applying the Business Opportunity Strength (Market x Technology x Design Execution) for Seed Capital Investment. The Multi Variable Linear Regression Model predicts investment worthiness, with regards to design execution performance and accounts for sixty-five percent of the variability with ninety-three percent accuracy.

2.6.1 Startups

First, applying Bridging Business and Design key element and their relationships can be established.

Second, with the Market - Technology Risk Matrix startups can position themselves for increased probability of receiving investors backing. When in the Sweet Spot, sixty-seven percent of the startups were financed, while in the second best area (Realizing Needs - applying New Technology) thirty-eight percent received financing, see Figure 6. This suggests that positioning can increase odds by a factor two or more.

Third, by applying the Capital Model, startups can attain a quick estimate of their capability fit within their selected position in the Market - Technology Risk Matrix.

Fourth, with the assistance of external experts, startups can apply the predictive model to assess their relative probabilities of success in the market – technology area they are pursuing.

2.6.2. Investors

First, applying the Market – Technology Risk Matrix, investors can optimize their portfolio of startups to align with the actual risk. Observed data suggests that investors current financing may be unbalanced, with a factor 2.5 (67/25) in the sweet spot and a factor 5.0 (38/8) in the realized needs – applying new technology. See Figure 5. However, more data is necessary for accurate evaluation and to estimate the remaining combinations of market and technology risk.

Second, by applying the Capital Model, investors can evaluate if a startup's capital is misaligned with their market – technology position and, if so, can aid them in exploring how they might contribute important Human and Social Capital, beyond the traditional Financial Capital infusion.

Third, applying the predictive model, investors can improve their selection of the twenty percent most promising startups from the candidates under consideration. Determining to what extent the selection has improved remains uncertain. However, comparing actual investments with optimal investments for the various market - technology areas, suggests that selection can be improved by a factor two.

2.6.3. Evaluation procedure

The proposed method requires that three or more external experts evaluate a startup's pitch describing the business opportunity together with the supporting design concept. They then have to evaluate the Design Execution performance along nine Design Quality Criteria together with two risk criteria. The reason three or more experts are required is to ensure sufficient convergence of the average. The benchmark used here being within ninety percent accuracy of what a nine expert evaluator panel would arrive.

3 CONCLUSION

We have introduced four models, the Bridging Business & Design (version 2.0), Market - Technology Risk Matrix, Capital Model and Business Opportunity Strength for assessing startups' key elements, strategic position, required capital and a Design Execution prediction model. The empirical study of startups in Silicon Valley and San Gabriel Valley, together with studies of South Korean engineering student projects and California design student projects, has provided the foundation for development of the Multi Variable Linear Regression Model predicting the Design Execution performance from three variables: Design Philosophy, Design Expression and Technology Risk. The model includes sixty-five percent of the factors determining the Design Execution and the predictive power has been tested on a separate data set, with ninety-three percent prediction accuracy.

Further development could include validating the prediction model on investors' portfolios and startups. Also, in establishing a link between startups' market and technology positions, Design Execution and market acceptance as measured by pre-ordering on such crowd-funding platforms as Kickstarter and Indiegogo. Finally, a double-sided investor - startup online platform could be launched to collect data on startup and funding for further development of the model's predictive power.

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