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PERFORMANCE ASSESSMENT OF DESIGN DRIVEN NEW ENTREPRENEURIAL VENTURES

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1. Introduction

1.1 Design driven new entrepreneurial ventures

New entrepreneurial ventures are ideal vehicles with which to compete in an increasingly volatile business environment, where user preferences are unpredictable and technology disruptions seem to come from nowhere [Christensen 2003], [Kimand and Mauborgne 2005], [Friedman 2008]. The combination of entrepreneurship, design and the Creative Economy offer a sweet spot here for breakthrough innovation. These are the unique products, services, experiences or hedonistic symbols, which will drive progress [McGrath and MacMillan 2009], [Johnson 2010], [SBA 2012], [GEM 2013]. In this context, becoming antifragile offers an avenue to prosper [Taleb 2012]. For incumbents, this could mean launching or funding a large diverse portfolio of new entrepreneurial ventures together with external partners or other investors, to mitigate the inherent risk in new ventures [Cooper 1998] such as new Google Venture and VEB Coca Cola. For these and conventional new entrepreneurial ventures this could mean pursuing breakthrough innovations by leveraging the power of design [Howkins 2002], [de Mozota 2006], [Gabrielsen 2008], [Brown 2009], [Petersen 2011], [Kelley and Kelley 2013], [Klenn 2016], [Petersen et al. 2016] in what we have coined as Design Driven Startups, which is short for design driven new entrepreneurial ventures.
The main competitive advantage of Design Driven Startups lies in their aptitude to create breakthrough innovative offerings, which clarifies needs or can realize new needs in combination with applying new technology or developing new technology [Moore 2002], [Reise 2011], [Blank 2012], [Theil 2014], [Petersen 2015a]. This inherently means taking on more compounded market, technology and execution risk [Girotra and Netessine 2014], [Petersen 2015a], a risk that entrepreneurs and investors today address with unfounded heuristics.

1.2 Challenge when assessing design driven new entrepreneurial ventures

The investment potential of any new entrepreneurial ventures are notoriously difficult to assess in their early phases, where the founders and their team are validating market and technology while concurrently building capabilities in executing business and new product development (NPD) [Heebøll 2008], [Terweisch and Ulrich 2009], [Wasserman 2012]. Due to the lack of hard facts, early phase investors rely on heuristics for assessing key performance factors, such as, the Management Team, Market Drivers, Product, Scalability of Business Model and Commercial Proof of Concept [Kawasaki 2004], [Terweisch and Ulrich 2009], [Osterwalder and Pigneur 2010]. Though there is agreement on the importance of innovation and design, no assessments address Market, Technology and Design Execution risk, as well as, Design Quality today [Petersen 2009].

This paper examines the issue of design in new entrepreneurial ventures and offers a practical risk evaluation and design valuation method. Partnering with the INDEX: Award, the worlds largest monetary design award with a focus on high impact, high context and high form development ventures, we audited the 2015 vetting process. We collected two hundred applicants, fifty finalists, five winners and ten candidates, worthy of pitching their venture to Venture Capital (VC) investors at an Investor Day, see Figure 1. We then assessed the Design Driven Startup's market, technology and executions risk, as well as, design performance, applying the Design Index, a composite consisting of the unweighted average of nine Design Quality Criteria [Petersen 2015e]. We found three key performance indicators (KPIs). Our analysis shows that investors' assessment of Design Quality correlate positively with Combined Risk (Market Risk x Technology Risk x Execution Risk), such that for higher risk ventures, a higher level of Design Quality (high Design Index) is required for being deemed investment worthy. Using this and other insights and assessments from entrepreneurs, experts and investors, it is possible, though triangulation, to predict a venture's potential.

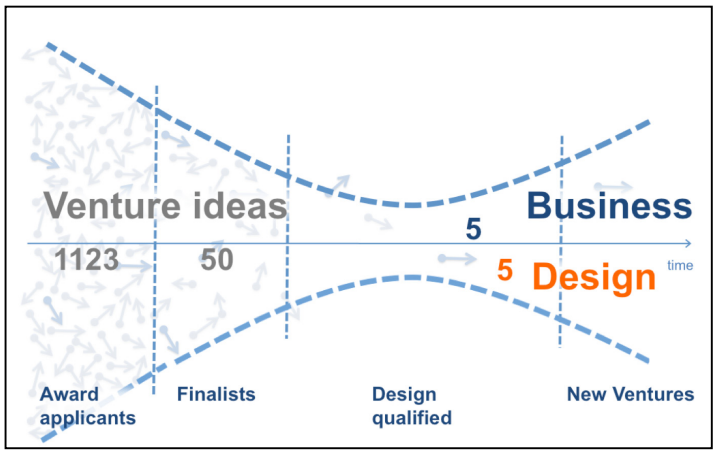

Figure 1. INDEX: Award design vetting process: applicants, finalists, winners and potential investment candidates

1.3 Design driven new entrepreneurial ventures performance

Today, top-tier VC firms perform on par with the NASDAQ Index [Masona 2002], [Petersen 2015a] when it comes to investing in new entrepreneurial ventures. Of firms receiving first time VC financing, a mere eighteen percent succeed and if the entrepreneurs achieve VC financing for a second startup, their success-rate improves by a mere two percentage points. For founders who succeeded in their first startup, their probability of success improved to thirty percent [Gompers 2006].

One way of mitigating exposure to the disproportionately large risk of breakthrough innovation's potential large revenues' is for design teams to prototype, test and learn though rapid release of a series of improved Minimal Viable Products (MVP) [Blank 2012]. Founders, presenting their investor pitch, then offer an opportunity to assess their design competencies and risk position for making 'go' / 'no go' decisions [Petersen 2015a]. However, the challenge, thus far, has been for teams and investors alike to assess risk and design quality.

1.4 Design procedures and metrics

Recent developments in design quantification and design award procedures provide assessment methods of the risk as well as design quality for Design Driven Startups, which then act as a predictor of investment worthiness [National Agency for Enterprise and Housing 2003], [Petersen 2007b], [Petersen 2009], [Westcott et al. 2013], [Petersen 2015a]. Design Quantification (DQC), derived from auditing 103 design awards and 81 design briefs, comprehensively describe expert designers' assessment of design. Additionally, DQC acts as a lead indicator of investors' evaluation of a new product [Petersen 2007b], as well as, the product's trendsetting ability [Petersen 2007a]. Design awards and DQC thus offer a stage for isolating and studying a wide range of Design Driven Startups. The DQC overlap with

the INDEX: Award criteria in the sense that Strategy (Philosophy, Structure and Innovation) corresponds to Impact, General Context to Context (Social/human, Environmental, Viability) and Form to Expression, see Table 1.

Table 1. Design quality criteria

Design Quality Criteria Explained	
▪Strategy	
• Philosophy:	What are the company's history, values, belief, vision, mission, and strategic intent? How is the brand communicated?
• Structure	In which business and category does the firm operate? What is its business model? How is it vertically and horizontally integrated, and what are its competitive advantages?
• Innovation	What is the business's innovation area (that is, technical, financial, process, offering, or delivery)? Is the innovation type Incremental or Breakthrough? What is the organization's level of ambition?
▪ Context	
• Social/human	What are the users' and other stakeholders' cultural connection, identity, needs, behavior, and activities?
• Environmental	What are the environmental requirements and expectations?
• Viability	What are the expectations regarding market share, ROI, and so forth, as related to the time horizons?
▪ Execution	
• Process	What are the project's budget, schedule, and deliverables? How are these aligned and coordinated with other projects?
• Functionality:	What is the nature of the deliverables: platform, modular, or custom product? What are the unique selling points and required number of SKUs? What are their technical requirements?
• Expression	What are the brand's attributes, design language, and design principles (proportion, surface and details)?

1.5 The INDEX: Award

In 2015, the INDEX: Award [INDEX 2015]; the world's largest monetary design award totaling €500,000 offered a unique opportunity to study how design and risk influences investor decisions of high impact, high context and high form development ventures. The INDEX: Award, established by the non-profit INDEX: Design to Improve Life® based in Copenhagen, 2002, introduced a 'new to the world' selection process to VC funding in 2015, applying the INDEX: Award evaluation process to the vetting of Design Driven Startups [Petersen 2015a]. See Figure 1.

From December 22nd to March 17th, organizations from across the world were invited to nominate candidates for the award's five categories: Body, Home, Work, Play and Learning and Community. Over the course of three months 1123 new ventures was nominated, from which INDEX: Award staff selected 50 finalists applying the unweighted criteria: Impact, Context and Form [INDEX 2015c]. Then an international jury consisting of thirteen members, all top tier specialists in design, exceeding the guidelines from 'icsid guidelines for design competitions' [International Council of Societies of Industrial Design 2015] regarding design assessment in international contests.

The pilot of the INDEX: Award VC investment vetting process resulted in the introduction of the Danish Ventures - Investing in Design to Improve Life foundation, with EUR forty million in capital [Petersen 2015f] to provide financing of promising future finalists. We were invited to partner on researching and communicating the design research insights as they were made. This paper describes how we leveraged

the new development in the INDEX: Award to assess potential VC investment objects, as well as, enabling the validation of previous findings of Design Driven Startups' performance in educational settings on industry projects.

1.6 Previous research

On research projects conducted at Hanyang University, South Korea, 2013, and University of California Long Beach, California, 2014, we examined the eleven parameters, market and technology risk (2) together with design quality (9). We found:
For the South Korean students a connection between a business opportunity's potential and design quality was found, as expressed in a business case supported by a design concept. The outcome of the graduate students' one-term project, as assessed by an external panel of judges, showed that Business Opportunity Strength (BOS), which is a multi-variable regression containing technology risk, design philosophy and expression criteria, correlated positively with the judges assessment of the design teams' letter grade performance [Petersen 2014], [Petersen and Ryu 2015].
Testing the general validity of the multi-variable regression model across culture, team/individual and profession, under similar conditions (project length, time commitment and similar project complexity) we applied the model on design students in California. Here, we showed a connection between the outcome of the undergrad product design students' one term project and BOS, as well as, Design Quality. We found that BOS and the Design Index correlated positively with an instructor's assessment of the individual student's letter grade performance. [Petersen et al. 2015].

1.7 Research - method and metrics

In this paper, we are applying the findings from South Korea and California to a combined hypothesis-driven and grounded research on the international INDEX: Award setting, with an even greater variety in project constellation. We examined how the original eleven metrics together with BOS and the Design Index correlated with the INDEX Award judging, founders', a design expert's and investors' assessment along the initial eleven parameters together with the investors' propensity to invest. Initially, we formulated the following two hypotheses, however were prepared to explore opportunities as they arose during the research.
H1: The Business Opportunity Strength, Design Quality Criteria, Design Index and/or Combined Risk (a product of market, technology and execution risk), as assessed by an external design expert, can, better than random, predict the Index Award jury's selection of finalists and winners from the pool of applicants.
H2: The Business Opportunity Strength, Design Quality Criteria, Design Index and/or Combined Risk, as assessed by the founders, a design expert and/or investors, can predict the investors' propensity to fund Design Driven Startups.

2. Research procedure

The research was designed with three independent phases, to prevent biases, and was conducted from April to August 2015. Phase 1: Assessment of applicants, Phase 2: Assessment of finalists and Phase 3: Assessment of winners and investment pitch-worthy candidates, as well as, investment worthy Design Driven Startups. Over the course of four months, a sample of two hundred randomly selected applicants together with fifty INDEX: Award employee (3) selected finalists were observed from a pool of over a thousand award applicants. These applicants were then down-selected to fifty finalists, by the INDEX: Award jury, finally arriving at five award winners, ten investment worthy candidates and followed by five investment candidates [Petersen 2015f]. The award assessments were done online based on online submitted videos, images and written descriptions.

2.1 Phase 1 research

In this phase, we establish a baseline for design performance, as well as, evaluate the DQCs alignment with the INDEX: Award jury's assessment of finalists. We did this by examining the Design Index's, ability to predict the INDEX: Award staff's selection of finalists as assessed by one expert using DQC.

To ensure unbiased assessments, the applicants had to be assessed prior the jury's assessment was revealed. To ensure a statistically high probability of having approximately two finalists in each category, an expert assessed a random sample of two hundred from the one thousand and twenty-three applicants, picking forty from each of the five categories. The design expert viewed the online presentation of the designs over the course of three days and scored these applying the Market - Technology Risk Matrix together with the nine DQCs. The market and technology risk, applying the Market - Technology Risk Matrix [Nielsen 1989], [Petersen 2013], was assessed on a scale from zero to one hundred percent probability of success. Execution Risk was derived by applying a Business Opportunity Strength algorithm [Petersen 2015a]. The DQC were assessed on a Likert scale from one to five (one being least and five being most.) Then, in random order, the presentations were viewed again, showing a high level of consistency (less than fifteen percent difference), and the average assessment was assigned to the Design Driven Startups. Data management was done in Excel and SPSS was applied for analysis at the completion of the data collection.

2.2 Phase 2 research

In this phase, we evaluated the DQCs alignment with the INDEX: Award jury's assessment of winners. The approach was similar to the one applied in Phase 1, except we assessed the fifty finalists selected by the INDEX: Award jury. The overlap in Design Driven Startups from the finalists identified in Phase 1, meant that only forty Design Driven Startups had to be assessed. Data management was carried out as in Phase 2.1.

2.3 Phase 3 research

In this phase, we evaluated the founders' (9) and investors' (4) assessments alignment with the design expert's assessment of the Design Driven Startups along the same parameters as in Phase 1 and Phase 2. At an investor pitch day, assessment forms were distributed and all founders, as well as, half of the investors completed the forms. Participants assessed market, technology and DQC applying the same metrics as in Phase 1 and Phase 2. Data management was handled as in the previous phases.

3. Findings

Studying the INDEX: Award, we learned how design experts, founders, and investors assess design driven ventures differently and how to best assess one's probability of venture capital funding.
The INDEX: Award applies Impact, General context and Form as criteria for first selecting the finalists and successively the winners. Applying only three unweighted criteria, applicants, by nature, will be very close in performance. The INDEX: Award jury is reported to reach an agreement relatively quickly on which designs have the biggest impact and fit within a certain general context. However, when it comes to reaching consensus on form (styling/aesthetics/expression), the selection process becomes a bit more difficult. This corresponds well to studies at Stanford showing that both design experts and other experts disagree more than laymen on what is good design [Petersen 2015b].

3.1 Phase 1 findings

In Phase 1, we found that when applying DQC, the difference in assessment between the fiftieth finalist and the twenty to forty runner-ups, vary within the accuracy of the scoring system (3-10 percent.) When the INDEX: Award jury assessed design driven ventures using their three criteria, they reported observing the same tendency. Conversations with previous jury members on various design awards confirmed this general tendency when judging entries. To address this, the IDEX: Award jury therefore applied multiple filters, such as novelty, news-worthiness and the desire to have a wide range of different entrepreneurial ventures in the mix and not simply many similar businesses. This deviation from a strict rank order makes a direct comparison of jury and design expert selection more problematic. When it came to risk, finalists were found to have a higher market and technology risk associated with them, as assessed by a design expert, see Figure 2.

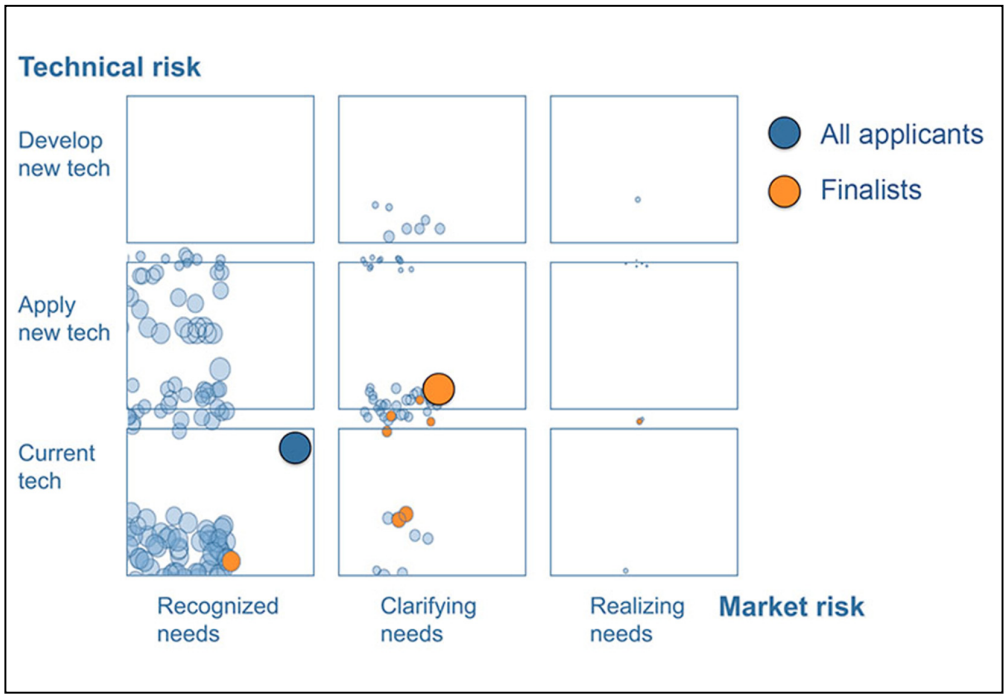

Figure 2. Applicants and finalists positioned in a market-technology risk matrix as assessed by a design expert

Even though there is a noteworthy similarity between DQC and INDEX: Award criteria (six of the nine DQCs are represented in the INDEX: Award criteria) one would expect a low fidelity in DQC identifying applicants, due to the INDEX: Awards deviation from strict rank selection. Applying DQC, we identified ten of the fifty applicants for all categories, which is approximately twelve percent better than would be expected by random selection. This is on par with the performance of a single design expert and that of a group of experts [Petersen 2015b]. For 'Home,' the category with the highest hit-rate, five finalists were identified, corresponding to thirty percent more than random.

3.2 Phase 2 findings

In Phase 2, the same challenges were found as in Phase 1. A single expert, applying DQC, could predict winners with an accuracy of forty-three percent better than random. The improved performance may be due to a an inherent relationship between Design Index score and Combined Risk.

For the applicants we found no correlation between Design Index and Combined Risk, however, for finalists, a medium negative correlation was found (corr = -0.439, $p<0.01$). For winners, probably due to the small sample size, we found only a low not statistically significant negative correlation between the Design Index and Combined risk (corr = -0.244), see Figure 4.

The design expert and the INDEX: Award jury seem to trade off Combined Risk and Design Quality when applying DQC and, for the high risk Design Driven Startups that are assumed to be associated with high impact, thus required a higher level of design quality for these to be selected.

3.3 Phase 3 findings

In Phase 3, we found winners to be somewhat located in the upper right area of the Market – Technology Risk matrix, while Design Driven Startups that were investment worthy seem to be distributed more evenly across the matrix, as assessed by a design expert, see Figure 3. For founders, a design expert and investors we found the same trend. Additionally, we made the following observations, see Figure 4:

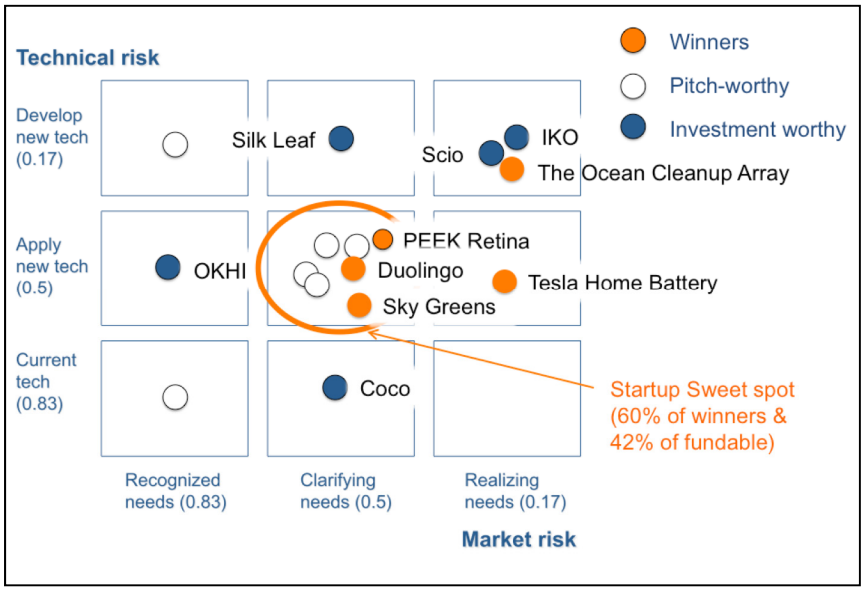

Figure 3. Market–technology risk matrix, displaying the position of IDEX: Award winners and ventures found to be promising investment candidates

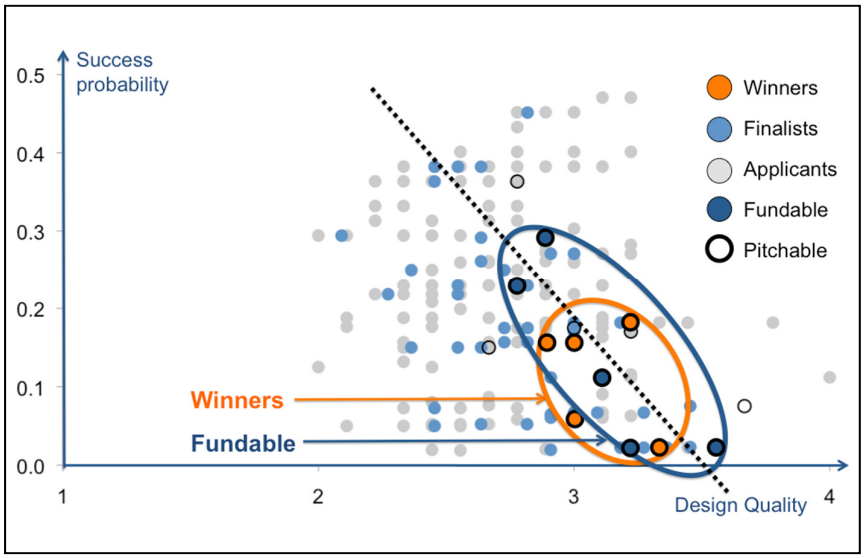

Figure 4. Design quality–success probability: higher risk design driven new ventures dictate higher level of design quality

3.3.1 Founder perspective

Founders tend to consistently overestimate their ventures and rate design quality approximately twenty percent higher than that of investors. Also, their assessment did not correlate with either that of investors or design experts. However, founders' assessment of technology risk correlated strongly with execution risk (corr = 0.782, $p<0.05$), i.e., the higher the technology risk, the higher the execution-risk, showing they understand the relationship between these two. They showed, however, no correlation between market risk and technology risk.

3.3.2 Design expert perspective

Design experts assessment of the design quality level, on the other hand, was on par with that of investors, although the two stakeholders assessments did not correlate. However, investors' and experts

Combined risk were medium correlation, though not significantly (corr = 0.433, $p<0.10$). As with founders, design experts' assessment of technology risk correlated strongly with that of execution risk, (corr = 0.877 $p<0.01$), showing they understand the relationship between these two, however, market risk did not factor into execution risk. See Figure 4.

3.3.3 Investor perspective

Investors' assessment of a Design Driven Startups' design quality correlated strongly with their propensity to invest (corr = 0.663 $p<0.05$). They also showed a strong correlation between their probability of investing and a design's structural performance (how well the design integrates with the venture's internal structure, as well as, the design's integration with the surrounding ecosystem and the supply chain.) (corr = 0.682 $p<0.05$). However, investors did not see technology risk and market risk as having an influence on execution risk.

3.4 Conclusion

The findings support hypothesis H1: Design Index, as assessed by an external design expert can predict the INDEX: Award jury's selection of winners better than random, and H2: Design Index, as assessed by investors, can predict a Design Driven Startup's investment worthiness and design. In addition design experts can predict the finalists. This is a significant contribution to the field of Design Quantification, which so far has only shown a link between established firms' design performance and financial metrics. The study also provides a range of unexpected insights useful for assessing the investment worthiness of Design Driven Startups.

We found Combined Risk and Design Quality to correlate negatively offering a useful prediction for investors when assessing Design Driven Startups. As determined by the INDEX: Award's, high-impact - high-risk, new entrepreneurial ventures demand an elevated level of design quality to be deemed worthy investment candidates for venture capital investors. The higher the risk, the higher the level of design quality required. Therefore, increasing one's probability for securing a venture capital investment, from half-a-percent to six percent, requires that the level of design quality be within the top one percent of the applicants.

In assessing risk on breakthrough innovative high-impact Design Driven Startups, founders, design experts and investors are flying blind when it comes to market risk. However, design experts and founders understand the link between technology and execution risk, investors understand the structural risk affect on investment worthiness and the link between design quality and investment potential. Therefore, combining the three stakeholders' assessments on Design Driven Startups provides a comprehensive evaluation of a new venture's design quality and risk. Triangulating founders, design experts and investors assessment can also aid in 'red flagging' discrepancies in the stakeholders' perspective. These combined assessments provide opportunities for further refinement of the venture's design and risk that can aid the founder's focus on needed improvements in their design performance.

Recommendations for future research would be to observe the applicants, finalists, winners and investment worthy candidates over time, around three to five years, to learn how design quality and investment versus non-investment relate to the probability of building a sustainable venture and completing an Initial Public Offering and thus becoming a real company.

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