Personal innovativeness as a predictor of entrepreneurial value creation

by

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Personal innovativeness as a predictor of entrepreneurial value creation

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Abstract

Purpose – The purpose of this paper was to determine whether innovativeness is a personal attribute that enhances entrepreneurial success and to obtain external validation for the Valuable Novelty Theory of innovation and the Innovator Mindset (IM) instrument for measuring personal innovativeness.

Design/methodology/approach – This is the final paper in a series of three articles. The first article, Valuable Novelty: A Proposed General Theory of Innovation and Innovativeness, laid out the Valuable Novelty Theory and the Innovation Cycle. The second article Evaluating Mindset as a Means of Measuring Personal Innovativeness explained the design of the IM instrument. For this study, some 300 entrepreneurs were given the IM assessment and asked to provide data on their ventures' recent performance. The data were then analyzed to see whether differing IM scores reflected different business outcomes. Due to the heavily skewed nature of the business performance data, this required the development of a non-traditional approach to data analysis that combined Rasch measurement, segmentation of the data into quantiles and hypothesis testing using simulations.

Findings – The findings were that there is a robust relationship between personal innovativeness and multiple measures of value creation. An unexpected finding was a Value Creation Curve, a non-linear pattern that appears to characterize the relationship between innovativeness and value creation regardless of the specific type of value.

Research limitations/implications – Key limitations of this study were that it was retrospective and focused on value creation in a particular endeavor – the launching of a new business. A longitudinal study with a control group would further clarify the relationship between innovativeness and value creation. Research in other settings is needed to explore the relevance of innovativeness to other types of value creation.

Originality/value – This is the first study to demonstrate and measure a relationship between personal innovativeness and entrepreneurial value creation, with effect sizes that appear to exceed any previously studied personal attributes. It confirms the role innovativeness plays in creating value, demonstrates the utility of the IM assessment as a research instrument and provides a tool that entrepreneurs and investors can use to more accurately predict the likely outcomes of business ventures.

Keywords Innovation, Value creation, Entrepreneurship, Assessment, Innovativeness, Predicting venture success

Paper type Research paper

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1. Introduction and background

Few research questions have been more tantalizing – or more elusive – than the decades-long quest to determine what characteristics distinguish great entrepreneurs. This study sought to reposition and answer that question in a way that is scientifically rigorous and measurable.

This quantitative research was a combination cross-sectional and retrospective observational study that compared an assessment of mindset to data on entrepreneurial performance. The purpose of this study was twofold: to examine entrepreneurs and the outcomes of their ventures as a means of testing the Valuable Novelty Theory of innovation and innovativeness (Stauffer, 2015a) and to determine whether someone's scores on the Innovator Mindset (IM) assessment (Stauffer, 2015b) can be used as a metric for predicting that person's likely degree of success as an entrepreneur.

Entrepreneurs, defined here as founders of new businesses, were chosen as the subject of this study for several reasons. First, because they would seem to need personal innovativeness to achieve their business objectives. Second, because unlike a more corporate setting, it is easier to identify who is making the key decisions that determine the fate of the venture. A business founder can be assumed to be making most if not all of the important strategic decisions, especially during the early life of a business. Another reason is that a start-up provides some straightforward metrics. Things such as profitability and whether the business survives can be used to gauge business success and value creation in ways that may not be as clear in other contexts.

1.1 Mindset

Mindset as it is applied by IM is based on the work of Dweck (2000, 2006), Dweck *et al.* (1995), who defines it as an "implicit theory". That is an assumption or belief that is not necessarily conscious, but that impacts how someone behaves, makes decisions and forms preferences. It can be thought of as a kind of personal paradigm (Stauffer, 2015b).

1.2 Valuable Novelty Theory

The theory of Valuable Novelty holds that there are common characteristics shared by all types of innovation, whether it occurs in the form of natural evolution, scientific and technological progress, business innovation, artistic expression, social change or other manifestations. The theory asserts that central to all types of innovation is the Innovation Cycle (Figure 1) that progresses in the following order:

- Idea Phase in which new possibilities are generated;
- Action Phase in which they are implemented to determine whether those possibilities will work;

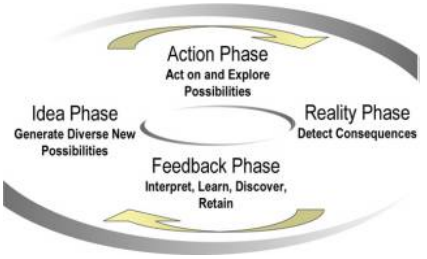


Figure 1.
Innovation Cycle

- Reality Phase in which the larger environment determines whether those possibilities succeed or fail; and
- Feedback Phase in which that feedback is evaluated and successes are retained and used to inform subsequent new possibilities, and back to the Idea Phase.

This theory also posits a Status Quo Cycle (Figure 2) with the same four phases but very different characteristics:

- Idea Phase that draws on existing knowledge and capabilities;
- Action Phase that applies that knowledge using established processes;
- Reality Phase in which any deviations from expected outcomes are resisted; and
- Feedback Phase in which that feedback is used to reinforce existing knowledge and established processes.

1.3 Innovator Mindset instrument

The IM instrument (Stauffer, 2015b) is designed to measure the degree to which a person follows the Innovation Cycle (Stauffer, 2015a) by evaluating their mindset (Dweck, 2006) – the beliefs they hold and assumptions they make about how the world works, both conscious and subconscious. It samples each of the four phases of the Innovation Cycle in three ways: a cognitive profile that examines beliefs, a values profile and a behavior profile, for a total of 12 dimensions (Stauffer, 2015b) (Table I).

IM is based in the Valuable Novelty Theory (Stauffer, 2015a) of innovation and innovativeness. The Valuable Novelty Theory describes innovation in all its forms, both human and non-human. The IM instrument operationalizes this theory in human cognitive/behavioral terms. It measures a person's innovativeness by posing a series of tradeoffs within each of the 12 dimensions that distinguish between a preference for either the Innovation Cycle or the Status Quo Cycle. IM also provides composite scores

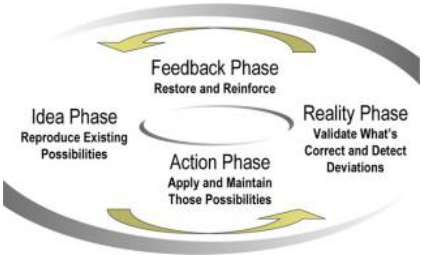


Figure 2.
Status Quo cycle

Phases Dimension	Idea Phase	Action Phase	Reality Phase	Feedback Phase
Cognitive profile	Idea cognitive	Action cognitive	Reality cognitive	Feedback cognitive
Values profile	Idea values	Action values	Reality values	Feedback values
Behavior profile	Idea behavior	Action behavior	Reality behavior	Feedback behavior

Table I.
Dimensions matrix

of the dimensions that make up each Phase and Profile, and for the instrument as a whole in the form of an Innovativeness Index (II).

1.4 Rasch methodology

IM was created and calibrated using the polytomous Rasch model (Rasch, 1960; Andrich, 1978), which uses log normal calculations to produce log odds units or *logits* that serve the same function as degrees on a temperature scale. Logits are uniform additive increments that measure the change in the probability of being innovative (in this application) by a factor of 2.718, the value of "e", the base of "natural" or Napierian logarithms (Linacre and Wright, 1989). Best practice with Rasch measurement would normally be to recalibrate the measures for a new data set such as this one. However, this data set of entrepreneurs was used to calibrate the first iteration of IM (Stauffer, 2015b), so no further adjustments were needed.

2. Hypotheses

This research tested two related general hypotheses: innovativeness is a predictor of entrepreneurial success, and entrepreneurial success is enhanced by innovativeness. This is to suppose that innovativeness is a valuable personal asset for a successful entrepreneur, and therefore, a measure of innovativeness should predict which entrepreneurs are likely to be most successful. Innovativeness is defined here as the capacity to produce valuable novelty by following the Innovation Cycle as measured by IM.

More specifically, this was a search for evidence of a relationship between how business founders scored on IM and the success of their ventures, as measured by profitability, revenue, number of employees, length of time from launch to first becoming profitable and failure rate. An analysis was also done on the relative probability of earning at least US$1 million, as a function of IM score:

H1. As IM scores increase, profit will increase.

H2. As IM scores increase, revenue will increase.

H3. As IM scores increase, the number of employees will increase.

H4. As IM scores increase, the length of time from launch to first becoming profitable will decrease.

H5. As IM scores increase, the failure rate will decrease.

H6. As IM scores increase, the probability of being exceptionally successful by having made a million dollars or more in annual profits will increase.

With no precedent for testing the Valuable Novelty Theory of innovation or the IM instrument, this study was both a test of specific hypotheses and a post hoc exploration to see what the data might reveal. This included a search for the most salient metrics among the IM scores and the indicators of entrepreneurial success. It is hypothesized that innovativeness, as measured in this way, has a probabilistic impact on the likelihood and magnitude of entrepreneurial outcomes, that it favorably shifts the odds of success.

3. State of the art

At a 1997 seminar on research perspectives in entrepreneurship (Sarasvathy, 1999), Nobel Laureate Herbert Simon suggested that entrepreneurship could be viewed within the larger perspective of novelty-producing human activity in general (e.g. scientific discovery and technological change), a view that is entirely consistent with the Valuable Novelty Theory. Simon also wondered aloud what role personal beliefs play in entrepreneurship, referring to attitudes about business prospects – "I think this is gonna happen; I think this can be done" (Sarasvathy, 1999, p. 12). Researchers have since explored how entrepreneurs shape such opportunity beliefs (Wood *et al.*, 2014) (Shepherd *et al.*, 2007). Other researchers have studied the impact of a variety of beliefs such as how entrepreneurs are influenced by personal self-assessments and cultural beliefs about gender (Thebaud, 2010) and the influence of sex role stereotypes (Fagenson and Marcus, 1991).

The approach taken here was to measure the impact of specific a priori beliefs that are relevant to the entrepreneurial challenge yet independent of context and contingencies. To ask: What beliefs – and what values, attitudes, behaviors and decisions that are prompted by those beliefs – are advantageous for an entrepreneur […] regardless of gender, the specific opportunity, market conditions, access to capital, etc.? Wood *et al.* (2014) took a similar approach when they hypothesized about the impact of *fear of failure*, but they examined its relationship to the entrepreneur's willingness to pursue an opportunity, whereas this study looks at business outcomes.

Innovativeness has been associated with entrepreneurship, both explicitly and implicitly, at least as far back as Schumpeter's work first published in 1911 (Schumpeter, 1934) and in the writings of Drucker (1985), among many others. But empirical research has examined it primarily as an attribute of firms and products rather than individuals. Where it is been studied in entrepreneurs, it is been treated as a personality trait, rather than a mindset or behavior. Multiple studies have used various personality trait scales to measure a preference for innovation (Mueller and Thomas, 2000; Stewart *et al.*, 1998; Carland and Carland, 1991; Goldsmith and Kerr, 1991; Buttner and Nur, 1993) such as portions of the Myers Briggs Type Indicator (Myers, 1962), the Jackson Personality Inventory (Jackson, 1994) and the Kirton Adaptor-Innovator scale (Kirton, 1976). Other researchers have focused on creativity (Ward, 2004; Amabile, 1997; Ko and Butler, 2007), but creativity is only one of the behaviors that the Innovation Cycle encompasses.

The traits research has focused primarily on what makes someone an entrepreneur (Gartner, 1988). As Begley wrote in 1995, "The field of entrepreneurship has few longer standing controversies than the one surrounding the question of what distinguishes entrepreneurs […]" (Begley, 1995, p. 249). Gartner argued that traits approaches to entrepreneurship make no more sense than selecting baseball players based on such things as height, weight, strength and personality, rather than their ability to play the game. He urged what he called a behavioral approach instead. The distinction is summed up in his statement that, "Research on the entrepreneur should focus on what the entrepreneur does and not who the entrepreneur is" (Gartner, 1988, p. 21). Sarasvathy followed a behavioral path in her seminal work on effectual thinking, a theory of how entrepreneurs in effect play the game differently than non-entrepreneurs, particularly established

business leaders (Sarasvathy, 2001); Baron, another critic of traits approaches, articulated a cognitive approach suggesting that entrepreneurs may instead tend to have specific cognitive biases and heuristics (Baron, 1998; 2004). Sarasvathy's work is also considered part of this cognitive thread (Mitchell *et al.*, 2007).

Krueger (2007) provides a vision of how the tools and insights of education theory and the cognitive sciences can be applied to this challenge. It is a vision that describes with considerable specificity the thrust of this study, when he writes of the need for, "cognitive research to explore […] deeply seated beliefs and belief structures that ultimately anchor entrepreneurial thinking" (p. 123). While he does not reference Dweck's work in educational psychology, his description of these deep beliefs is very close to her description of the "implicit theories" (Dweck, 2000) that comprise a person's "mindset" (Dweck, 2006), and that provided a theoretical framework for the design of IM (Stauffer, 2015b).

> […] such beliefs play a pivotal role in what we perceive as relevant in new knowledge, how we process stimuli and information, and finally, how we store and structure the knowledge resulting from these steps. Yet, most of us are unmindful of our deep beliefs or their impact on the ways we perceive, think, and feel. (Krueger, 2007, p. 124).

Behavioral, cognitive and traits approaches have all focused primarily on identifying characteristics that distinguish entrepreneurs from non-entrepreneurs. It is a focus reiterated by Mitchel who argued that the central question of entrepreneurial cognitive research should be, "How do entrepreneurs think?" (Mitchell *et al.*, 2007, p. 3).

This work takes the Gartner and Mitchel questions a step further. The most salient question is not: What do entrepreneurs think … or do? But the normative: What *should* they think and do in order to be most successful? Is not answering that question the fundamental purpose of this entire body of research? The unarticulated assumption has been that the way to find that answer is by inductively examining the characteristics and behaviors of successful entrepreneurs. That is certainly a good place to look but it is not the only approach that can be taken. The approach taken here examined the wide variability in performance *among* entrepreneurs. The premise is that innovativeness is a high value mindset for an entrepreneur, not that all successful entrepreneurs necessarily have it, or that non-entrepreneurs do not. It would be entirely consistent to find that the same mindset that is advantageous for entrepreneurs is also advantageous for non-entrepreneurs.

4. Data set

4.1 Participants

In the May of 2012, The Kauffman Foundation for Entrepreneurship began the final round of annual data gathering in its Kauffman Firm Survey longitudinal study of new businesses that launched in 2004. In that concluding survey, participants were invited to complete the IM self-evaluation.

In early 2013, 328 of these entrepreneurs completed IM online and were scored on the 12 component dimensions, the composite Phases and Profiles and the II. Of those who completed the self-evaluation, most disclosed data about their venture's performance such a revenues, profits and number of employees for the previous year (2012) or indicated that they had no revenues or profits or were not in business in 2012. The data set used for these calculations consists of those participants for

whom there were both IM scores and the relevant performance metrics, so *n* varies by hypothesis according to the number of participants who provided the needed information.

Participants included 234 men and 94 women, from 43 states and the District of Columbia. The types of business ventures varied widely, from lawn care service to biotechnology, in diverse sectors that included retail, hospitality, manufacturing, transportation, technology and professional services. All participants self-reported being a founder or other key decision-maker in the fate of the venture. No attempt was made to control for specific kinds of business ventures, industries or sectors. The focus of this study was not on identifying entrepreneurial characteristics *per se*, or the characteristics of businesses, but rather on determining whether innovativeness is advantageous to entrepreneurs and to what degree. In such a quest, it made sense to explore a diverse population.

This is not to say that the nature of the business venture is irrelevant. This was an exploration of the impact of innovativeness on the *pursuit* of a business venture, *and* on the *selection* of the type of business to pursue. Both are among the many things an entrepreneur must do well to be successful, and both are impacted by the entrepreneur's mindset. Controlling for either of these factors so as to remove it from consideration would provide a less complete picture. (Although that may be appropriate for further research.)

4.2 Data distributions

The distributions of IM scores approximated a normal (Gaussian) distribution for all dimensions and their composites, but this was not the case for the business performance data. The distributions of values for profits, revenues and number of employees were extremely skewed. Researchers (Crawford *et al.*, 2015) have found that this is no aberration, despite the widespread treatment of these variables as normally distributed in entrepreneurship research. An examination of 49 input and output variables used in theories of entrepreneurship found that 48 were power law distributions, including revenues and number of employees. One of the data sets explored in that study was the Kauffman Firm Survey that included the participants in this study. The authors found "strong evidence that the norm of normality in entrepreneurship research is not empirically justified" (p. 3) and concluded that "*Variables of interest should be assumed as PL (power law) distributions unless proven otherwise*" (Emphasis in original) (p. 10). In this data set, profits, revenues and number of employees all displayed classic power law frequency distributions (Figure 3).

5. Data analysis

Each of the business metrics hypothesized to be impacted by the founder's IM Score was compared to the founder's II and in some cases individual dimension scores.

The heavily skewed nature of the data posed some challenges for data analysis. As Christopher (2015) noted, this makes many of the standard tools of statistical analysis, including ordinary least squares and ANOVA, inappropriate because they require a normal distribution. It was also inappropriate to drop extreme values as outliers, as they represent the performance of those firms that are most successful and therefore of the greatest interest in this research. (It was also mathematically

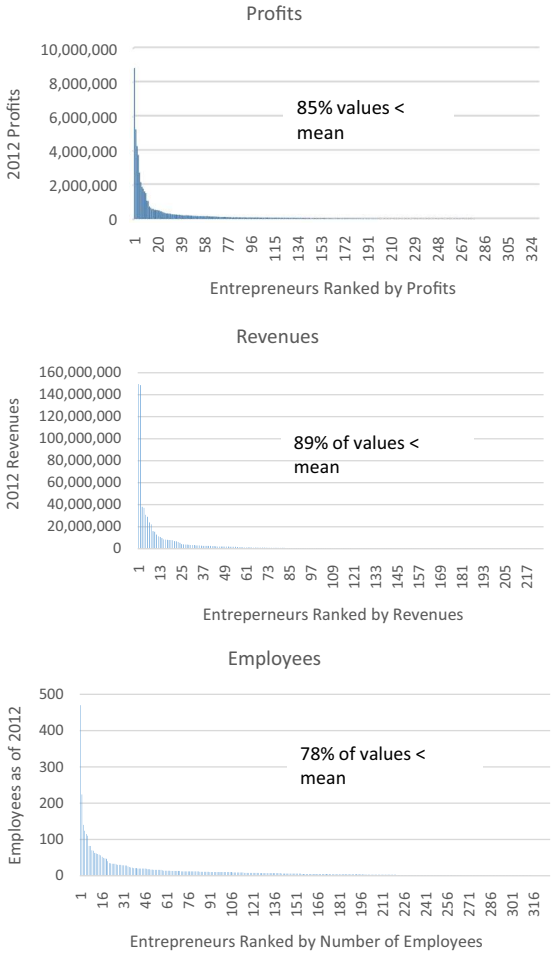


Figure 3.
Business outcomes distributions

futile. As an experiment, these "outliers" were removed and the effect was simply to create new outliers as the distribution shifted.)

An alternative to more typical analytical approaches was possible owing to the nature of the IM instrument. Its uniform linear measurement made it possible to compare the relative amount or *concentration* of value (e.g. profits, revenues, employees, etc.) as one moves incrementally along the II or its component dimensions, just as one might measure the amount of heat at incremental distances from its source.

The data were noisy and highly variable. When the values for business metrics were ranked according to the founder's II, extremely large values were interspersed with very small and zero values. To reduce the distorting effects of these extreme values, they were grouped into quantiles of II scores, and a mean was calculated for each of these groups. Where a quantile contained three or fewer values – something

that happened at the extremes of these scales – those values were combined into the adjacent quantile.

5.1 Controlling for time since launch

While most of the companies in this data set said they launched in 2004, some reported results of businesses they said began significantly earlier or more recently, so it made sense to control for the variable of time since launch.

The months from launch to 12-12-2012 were calculated for each company, and the mean value (102 mos.) was divided by the number of months of each company's existence to create a value which was then multiplied against reported revenues and profits for the previous year (2012). The formula used was:

$$\frac{M}{T} * P = P_T$$

Where M was the mean number of months, as all of the ventures in the sample were founded, T was the number of months as a specific venture was founded, P was the profits or revenues reported for that venture for 2012 and P_T was the venture's 2012 profits/revenues weighted for the length of time the venture had been in existence as of the end of 2012.

This had the effect of increasing the reported revenues and profits for recent startups and decreasing the reported revenues and profits for older ones in proportion to their distance from the mean. The impact of this adjustment was small and did not substantially impact the findings. Still, unless otherwise specified, subsequent references to profits and revenues are time-weighted rather than actual.

5.2 Measuring the innovation challenge

Participants were asked to rank their ventures based on five criteria designed to reflect the degree of innovation that their venture required, the venture's *Innovation Challenge* (IC). This was done using seven-point Likert type scales for:

(1) product/service category (Very well established […] Very new);

(2) core technology (Very well established […] Very new);

(3) market space (Very well defined […] Very undefined);

(4) buyer (Very easy to reach […] very hard to reach); and

(5) business model compared to competitors (Very similar […] Very different).

5.3 Profits

Of those who participated, 277 (*n*) disclosed their profits for 2012. Profits were ranked according to each entrepreneur's II score and the resulting distribution showed little or no clear pattern and a trend line moving slightly upward (Figure 4). To reduce the distorting effects of the extremely large values, reported profits for 2012 were divided into 20 quantiles (five-point groupings) based on the corresponding score. When this resulted in three or fewer entrepreneurs being grouped together, adjacent groups were combined. This resulted in categories that began with those who scored less than 35 and continued in five-point increments up to greater than 70, a total of nine groupings. Calculating the mean for each group's profits showed a clear pattern, one that became

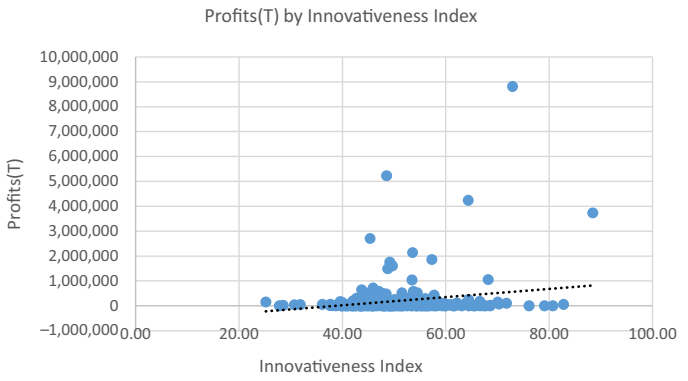


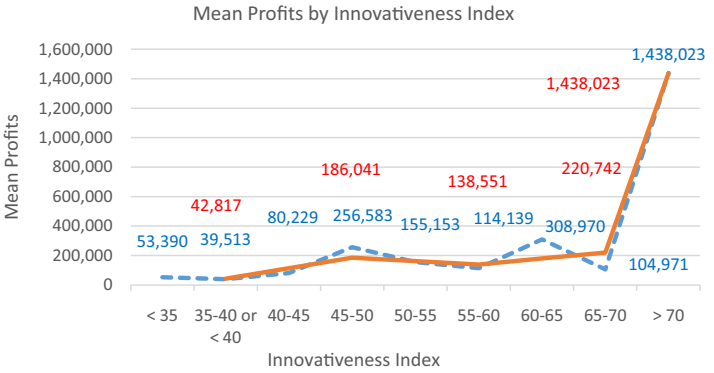
Figure 4.
Profits scatterplot

still more distinct when mean values were calculated by decile (ten-point increments). Figure 5 shows the accelerating upward trend this revealed. Five-point scaling is in blue, and ten-point scaling is in red.

The difference in the concentration of value creation was dramatic. Mean profits for the highest scoring group were seven times higher than overall mean profits for this dataset and 34 times higher than mean profits for the lowest scoring group (Table II).

5.4 Incidence of "millionaires"

For this population, the overall probability of having a venture that made US$1 million or more the previous year was 4.3 per cent or about 1 in 23, but it was not evenly distributed. The lowest scoring "millionaire" scored at 45. So, for anyone with an II in a decile below 40, the probability was 0. Between 40 and 50, the probability was just 3 per cent and 7 per cent



Notes: In this and subsequent graphs, confidence internal bars have been omitted because the business performance data do not fall into a normal distribution (as discussed in Section 4.2), introducing potential bias into the calculation of those intervals, Hypothesis testing was done based on simulations, as explained in Section5.13.

Figure 5.
Profits by quantile

Table II.
Simulation probabilities and effect sizes

	Extreme quantiles					
	Highest		Lowest		Effect size	
Comparisons	Value	p	Value	p	High/Mean	High/Low
Mean profit by II score	1,438,023	**0.0023**	42,817	**0.0301**	7:1	34:1
Mean profit by minimum dimension score	1,163,097	**0.0031**	56,990	0.2680		
Mean profit by maximum dimension score	778,652	**0.0013**	23,210	0.2022		
Mean revenue by II score	2,610,645	**0.0169**	381,825	**0.0095**	8:1	70:1
Mean employees by II score	59.89	**0.0174**	5.85	**0.0365**	5:1	10:1
Mean months to first profits by II score	25.71	0.2381	13.65	0.1318		
Probability of earning US$1M+ by II score*	0.22	0.0551	0.00	**0.0471**	5:1	>22:1
US$1M+ by minimum dimension score*	0.25	**0.0130**	0.00	0.3332		
US$1M+ by maximum dimension score*	0.16	**0.0209**	0.00	0.8764		
Mean failure rate by II score*	0.33	0.3993	0.24	0.6325		
Failure rate by II score – IC score*	0.11	0.2440	0.50	0.0781	2:1	5:1

Notes: *Based on binomial probability calculations; II stands for Innovativeness Index and IC stands for Innovation Challenge; values correspond to highest and lowest values in the previous figures; bolded values are statistically significant at $p = 0.05$

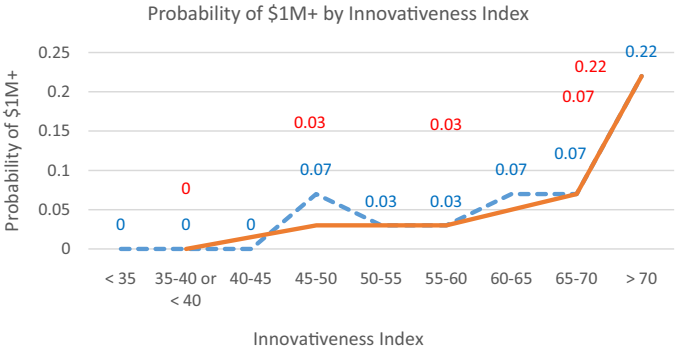
between 60 and 70, respectively. For those scoring 70 or above, the probability jumped to 22 per cent (Figure 6). This too revealed an upwardly accelerating curve with an effect size of 5 to 1 between the highest scoring group and the overall mean.

5.6 Minimum and maximum scores

As a test of the importance of the Innovation Cycle in its entirety, participants were ranked according to their minimum score on any one of the 12 IM profiles, and also according to their maximum score. The plot of mean profits based on minimum scores by decile (Figure 7) again generated the same upwardly accelerating curve. The plot of maximum scores also showed this pattern.

5.7 Revenues

Of the study participants, 226 (*n*) disclosed their 2012 revenues (including those who specified that they had none or were no longer in business), and these were



Note: P(A|B) where A is having made a million dollars or more the previous year (2012) and B is a participant's score on the II

Figure 6.
US$1M probability by quantiles

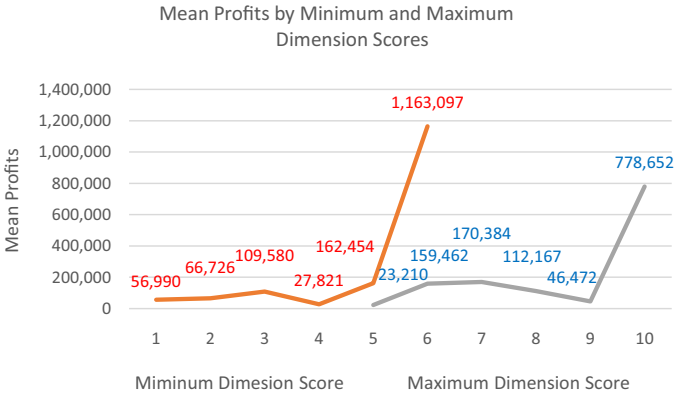


Figure 7.
Minimum and maximum score quantiles

time-weighted in the same manner as profits. Participants were again grouped into quantiles based on their scores on the II. Figure 8 shows the same pattern of increasing value creation and an effect size of 8 to 1 between the top scoring group and overall mean revenues, and 80 to 1 between the top and bottom scoring groups.

5.8 Job creation

Of those who participated, 324 (*n*) provided a count of the number of fulltime, part time and contract employees they had in 2012. These were combined into a total number of employees for each venture. Participants were grouped into quantiles based on their scores in the same manner as with the profit and revenue calculations. This also revealed a generally upward accelerating trend in the average number of employees as the founder's II increased (Figure 9).

5.9 Time to first profits

Among the study participants, 242 (*n*) provided the month and year when their venture launched, and the month and year when it first turned a profit. Based on these two dates, the number of months to first profitability was calculated, and participants were grouped by 5 and10 point quantiles of scores on their II. Mean time values trended

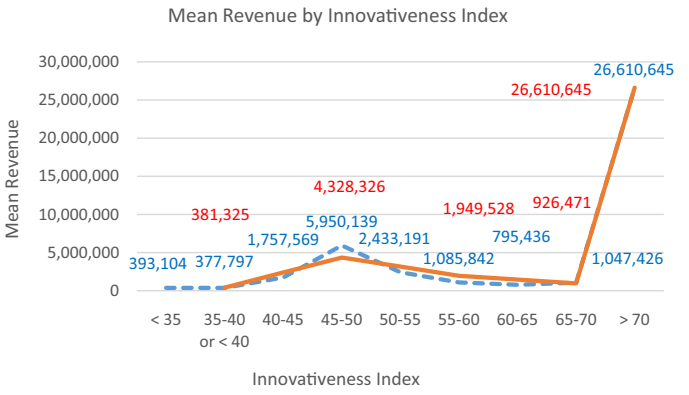


Figure 8.
Revenue by quantiles

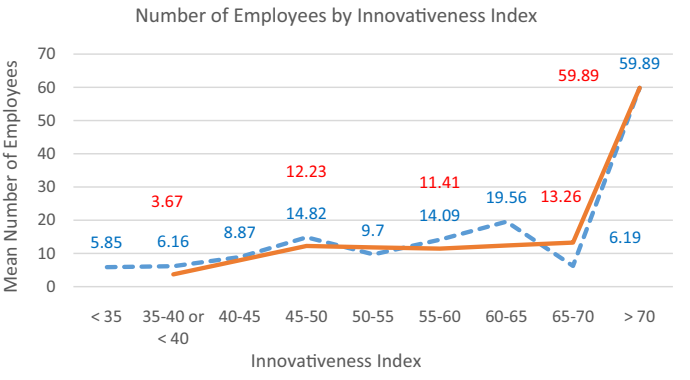


Figure 9.
Employees by quantiles

upward as the II score increased (Figure 10) showing a small *positive* relationship between IM score and mean months to first profit, not the negative relationship hypothesized.

5.10 Failure rate

Among the participants, 63 reported no profits in 2012 and an additional 7 reported that their venture was no longer in business, for an overall failure rate of 0.25. These failures were dispersed throughout the II, with variability that was not statistically significant at $p < 0.05$ for any quantiles along the scale (Figure 11).

Alternative calculations were made that considered both the II and the IC. The IC was created by adding together the rankings for each of the five IC scales and converting that range of values into a 100-point scale. This was then subtracted from the II value (also 100 point scale), and the range of values for the differences between the two were converted into a 100-point scale. Entrepreneurs were ranked along this II-IC scale and divided into quantiles in the same manner as rankings along the II. The failure rate was then calculated for these five- and ten-point quantiles (Figure 12).

This revealed that the greater the founder's II *relative to* the venture's IC, the lower the failure rate. However, this downward trend was not statistically significant at $p < 0.05$.

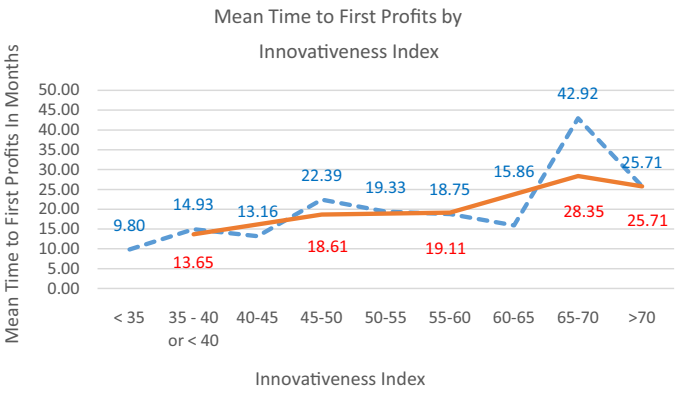


Figure 10.
Time to first profits by quantiles

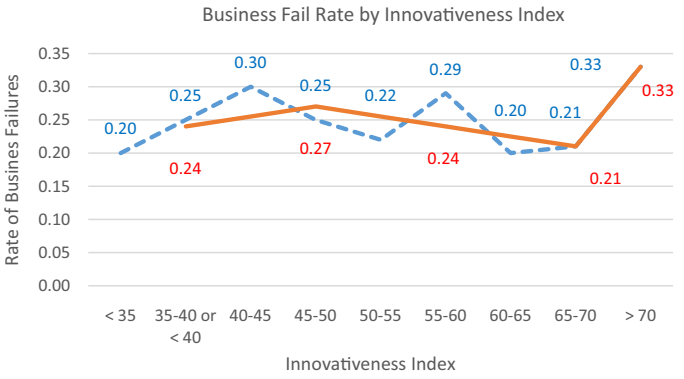


Figure 11.
Failure rate by quantiles

5.11 Elites

There were 12 participants who scored no less than the mean (50) on any dimension, meaning that they at least minimally favored the Innovation Cycle over the Status Quo Cycle across all dimensions, phases and profiles. This group had mean profits of US$1,163,097, more than five times the data set mean of US$202,693. The percentage who earned at least one million dollars was 25 per cent, compared to 4 per cent for the data set as a whole (Table III).

There were three participants who scored at least 80 on the II. One of them (33 per cent) earned at least a million dollars. Mean profits for this group were US$1,265,524 or more than six times the mean for the data set. There were 25 participants who maxed out at least one of the dimensions at 100. Four of them were millionaires, and their mean profits were US$778,652, almost four times the data set mean.

Table III lists these elite scoring groups and some combinations that produced even higher profits and rates of millionaires, along with confidence levels based on binomial calculations of expected probabilities.

5.12 Concentration of value creation

Table IV shows the dramatic difference in share of value creation that occurred between those in the top 10 per cent when ranked by II, compared to the bottom 10 per cent. The top group created 24 per cent of revenues, 34 per cent of profits and 23 per cent of the jobs produced by the data set as a whole. The bottom group created just 1 per cent of revenues, 2 per cent of profits and 5 per cent of the jobs.

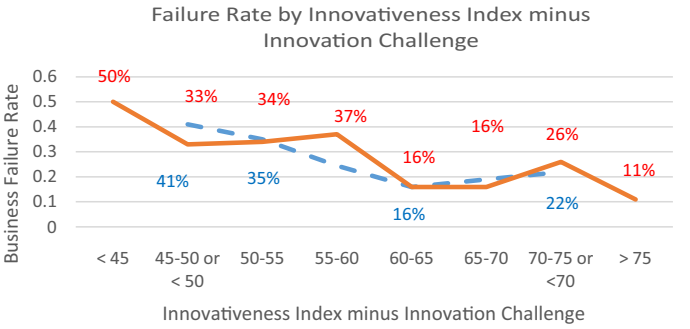


Figure 12.
Failure rate by quantiles (II-IC)

Groupings based on IM scores	Participants	Mean profits (US$)	No. who earned US$M+	% who earned US$M+	Confidence level
(1) Data set	277	202,693	12	4	
(2) Index score of ≥ 70	9	1,438,023	2	22	0.95
(3) Minimum dimension score ≥ 50	12	1,163,097	3	25	0.99
(4) Maximum dimension score = 100	25	778,652	4	16	0.98
Index score ≥80	3	1,265,524	1	33	0.88
Both (2) & (3)	6	2,139,951	2	33	0.98
Both (3) & (4)	5	2,733,503	3	60	0.99

Table III.
Elite scorers

5.13 Hypothesis testing using simulations

For all of these hypotheses, the null hypothesis was that these apparent trends are actually random events, and therefore, someone's II or dimension score is not a factor. To rule that out, a series of random simulations were done *with this data set* to determine the probability of the null hypothesis being true in each instance. If the null hypothesis is incorrect, theory suggests that this is most likely to occur at the extremes of the II, where either the Innovation Cycle or the Status Quo Cycle is strongest. So the highest and lowest group mean values were selected from each comparison (profits, revenues, employees, etc.), and the number of entrepreneurs that happened to be in those extreme groups was noted.

Simulations were conducted using the following procedure:

- Values for the comparison variable (profits, revenues, employees, etc.) were randomized using Excel 2013.
- x values were drawn from this randomized pool, with x being the number of entrepreneurs in that quantile grouping for that comparison.
- A mean value was calculated for the x drawn values.
- This was repeated 10,000 times for each comparison and the resulting mean values listed.
- The number of listed values that were at least as extreme as the actual mean value for that grouping, was divided by 10,000 to determine the probability that such a value could have occurred at random.

These calculations still produced heavily skewed distributions, but they made it possible to directly observe the probability of obtaining a value at least as extreme as that produced by the above comparisons. A test was done to determine whether this procedure would produce stable values, by running ten such simulations for profits as a function of the II. Each run produced a series of unique values; yet, the total range of the probabilities for producing a value of at least US$1,438,023 was just 0.0014 across all ten simulations, so variability was slight.

This procedure was repeated for each comparison variable except for the number of "millionaires", and the number of failures […] which were compared to expected probabilities with simple binomial calculations.

Table II lists the highest and lowest groups for each comparison with their corresponding p-values. The probabilities in bold are those that are significant at $p < 0.05$.

These simulations found that the differences in mean values were statistically significant ($p < 0.05$) in both the highest and lowest groups for profits, revenues and number of jobs created.

Table IV. Share of value creation

Entrepreneurs ranked by II (%)	Revenues (%)	Profits (%)	Jobs (%)
Top 10	24	34	23
Bottom 10	1	2	5

They were statistically significant at the high end for minimum and maximum dimension scores, and significant at the low end for the probability of earning at least one million dollars in profits.

Table II also shows effect sizes for key business metrics, comparing the highest group mean to the overall mean and the highest group mean to the lowest group mean.

6. Findings

6.1 Hypotheses

Both general hypotheses are supported by this study. Analysis of the data showed a statistically significant relationship between an entrepreneurs IM scores and indicators of the performance of the ventures they founded. This included revenues, profits and the number of jobs created:

- The Valuable Novelty Theory of innovation, as expressed in the IM instrument and measured on the II, was a probabilistic predictor of value creation in real world business settings.
- Innovativeness is an attribute that was found to be helpful (and at the high end very helpful) in meeting the challenges that entrepreneurs face. It is not essential; some entrepreneurs achieved high levels of success, despite relatively low IM scores. But it predicted significant shifts in the probability of being one of those successes, and the degree of that success.

For the hypotheses that stated as IM scores increase, (*H1*) profits increase, (*H2*) revenues increase and (*H3*) the number of employees increases, the null hypothesis is rejected. At both ends of the II scale, there is a statistically significant relationship between how an entrepreneur scores and these business performance metrics. So these data support all three of these hypotheses. The relationship between IM scores and these business metrics was less clear in the midrange of the II scale ,but that too is evidence of the impact of the Innovation and Status Quo cycles. It indicates that as these patterns become stronger their impact becomes more definitive.

The hypothesis (*H4*) that stated as IM scores increase, the length of time from launch to first becoming profitable will shrink was not supported by the data. The null hypothesis could not be rejected, and there was evidence that the opposite trend may be the case – that it took longer to achieve more innovative outcomes.

The hypothesis (*H5*) stated that as IM scores increase, the failure rate will go down was not supported by the data at a 0.95 confidence level. There was no statistically significant variation found in the failure rate throughout the II or the II minus the IC. However the latter calculations did appear to reveal a trend that may be statistically significant with a larger population.

The hypothesis (*H6*) that stated as IM scores increase, the probability of having made a million dollars or more in profits will increase, was partially supported by the data. A dearth of these "millionaires" at the low end of the II was statistically significant ($p < 0.05$). At the high end, the increased number of millionaires in the highest scoring quantile (>0.70) was not statistically significant. However, the single highest score was a millionaire ($p = 0.043$), as were two of the top 6 ($p = 0.025$) and three of the top 12 ($p = 0.013$); these occurrences were all statistically significant. The number of millionaires who scored at the top of the scales of

minimum and maximum dimension scores were also statistically significant. Combining the scores on the II and the minimum and maximum dimension scores raised these values still higher (Table IV). Taken together, these results would seem to rule out the null hypothesis, but they are inconclusive.

6.2 Value creation curve

An unanticipated but important finding was that the trend lines for profits, number of "millionaires," revenues and number of employees (Figures 5-9) were all remarkably similar. No matter what form value creation took, the trend showed the same underlying pattern. I call this trend the V*alue Creation Curve,* which is defined as the increase in value creation that occurs as the II increases. It was characterized by:

- *An ascending curve* that showed average value creation increasing as innovativeness increased.
- *An accelerating rate of increase* that was most dramatic at the high end.
- *A tipping point* near the high end of the scale. As the Innovation Cycle was followed most strongly and consistently, value creation climbed more steeply as though some threshold had been crossed once the Innovation Cycle fully "kicked in". Notably, this tipping point appeared in approximately the same place on the II (circa 70) across all value measures.
- *No point of diminishing return* – value creation did not show a decline or even decelerate at the high end.

The II provides a uniform linear measurement from favoring the Status Quo Cycle to favoring the Innovation Cycle. But the Value Creation Curve showed that the impact of this preference was dramatically nonlinear. The same incremental change in score on the II produced a much larger gain in average value creation at the high end of the index, than it did at the low end.

7. Discussion

This study provided significant empirical support for the Valuable Novelty Theory of innovation and external validity for the IM instrument as a predictor of value creation. The results of this study are what one would expect to find when looking for an influential pattern in the midst of otherwise random events.

The key findings of this study are found in the calculations comparing founders' scores on the II to business profits, revenues and number of employees. All showed a similar pattern of value creation, providing significant empirical support for the claim that innovativeness is a high value mindset for entrepreneurs. No one in this data set scored at the top or bottom of the II. So, given the shape of the Value Creation Curve, it appears that the potential difference in value creation is even greater than these calculations showed.

IM as a measure of innovativeness cannot reliably predict the success of any particular entrepreneur or venture. (Nor can any other approach.) The vast majority of business founders were found to not strongly and consistently exhibit an IM, including some who were highly successful. But what this study found was that on average those

few who had such a mindset achieved dramatically higher levels of value creation – that the probabilities shifted significantly.

This lack of precision in predicting individual success may simply be detecting some of the characteristics of innovation. The Valuable Novelty Theory argues that innovation is a fundamentally stochastic process in business as it is in nature (Stauffer, 2015a), that failure is always a possibility, and it is just not possible to reliably predict which specific innovation attempts will succeed and which will not. While such a predictive capability would truly be a breakthrough, it overstates what this study sought to discover.

The evidence in this study is not strong enough to conclude that the Innovation Cycle can reduce the failure rate. Reducing the failure rate of new ventures has been called, "one of the holy grails of research in entrepreneurship" (Sarasvathy, 2001, p. 259). Although measurably increasing value creation at the same failure rate is surely a good alternative, and that is something this study found that the Innovation Cycle does. This study suggests that there may be utility in using the II minus the IC as a way to predict the probability of failure for entrepreneurs. Research with a larger population might show whether the apparent downward trend in the failure rate, as the II increases relative to the IC, is a real phenomenon and not the result of random variability.

Stochasticity in business is of course not a new insight. It is a tenet of evolutionary economic theory (Nelson and Winter, 1982); it is something that Simon explored with regard to the size distribution of firms (Simon and Bonini, 1958); Arrow suggested it may determine the success and failure of new ventures (Sarasvathy, 1999). The findings of this study suggest that the Innovation Cycle makes it possible to favorably shift the odds of successfully navigating the randomness of business, just as it does in the randomness of nature.

The finding that time from launch to first profitability does not decline and may increase on average as IM scores increase, was not anticipated but it makes sense. It means that the more innovative the approach, the longer it may take on average to produce new value – a reality even the Innovation Cycle cannot overcome.

As all of the attributes measured by IM are discretionary, it should be possible to teach entrepreneurs and other aspiring value creators how to leverage the Innovation Cycle, and in so doing improve the odds and the amount of their success. There appears to be no upper limit to the benefits of such a mindset, as reflected in the Value Creation Curve. The impact of providing instruction in how to leverage the Innovation Cycle should be studied.

Only a relative handful of study participants scored near the extremes of the IM scales. In some cases, changing just one or two values could significantly impact these findings. Further research is needed with a larger population to better identify effects at these extremes, especially at the high end. Research is also needed to answer the obvious question:

RQ1. How much does mindset and innovativeness impact entrepreneurial performance and how much does entrepreneurial performance impact mindset and innovativeness?

It is reasonable to suspect that success as an entrepreneur might tend to foster innovativeness. But it also seems plausible that whatever mindset someone has

when they achieve success, would be what they believe is the cause of that success. So a prospective study would presumably produce much the same results as this retrospective one. A longitudinal study would help provide some answers.

Further research is also needed into how innovativeness, as measured this way, impacts value creation in other areas such as in R&D, new product development, the sciences, education, non-profits and government. Nothing in the IM instrument focuses on entrepreneurship *per se*. So there is good reason to suspect that the Innovation Cycle may be just as effective in enhancing other types of value creation.

Other questions for further research include:

- Are some types of ventures more sensitive to the need for innovativeness than others?
- Can these findings be replicated within a more homogenous population, such as within a particular industry or company?
- What are the benefits and impacts of innovativeness for individuals generally? Does it enhance personal income? Does it influence career choice? Does it impact success, personal effectiveness, or value creation in other business and non-business related endeavors?
- To what degree is innovativeness consistent or variable among different cultures, and how is that reflected in innovation outcomes including entrepreneurial activity and success?
- Is the Value Creation Curve a product of the long tail distributions that it approximates in this study, or does it help explain why such distributions occur? And, will this same curve be found in other contexts where value creation may not have this kind of distribution?

Another implication of this work is that innovators and researchers may be putting too much emphasis on the quality of initial ideas. Ideas are important, but this work and the theory behind it argue that they are no more important than the other Phases of the Innovation Cycle, that they only create value when they work within that larger context. The characteristics of the innovator appear to be as important, if not more important than ideas, because that is what determines what happens to those ideas. This shift in emphasis from idea to context is an important aspect of LEAN Startup (Blank and Dorf, 2012; Ries, 2011) that is gaining acceptance as a methodology for entrepreneurs. This research supports such approaches.

This research should not be interpreted to mean that innovativeness somehow trumps other personal attributes or behaviors of entrepreneurs. This was not a comparison of various assessment criteria, such as those an investor might use to evaluate an entrepreneur or venture. These findings do not indicate that things like relevant technical expertise, industry experience, commitment and good connections are unimportant. Rather, the findings suggest that innovativeness is an *additional* criterion that should be considered, that mindset should be on the short list of metrics that are relevant and, unlike many other attributes, it is measurable and probabilistically predictive. Innovativeness is a metric that has the potential to dramatically enhance investment portfolio rates of return, which are after all a product of the probabilities. It is a high value attribute that should be prized by investors and cultivated in entrepreneurs.

Business success certainly seems to have a random component, a degree of luck (good and bad). In such an environment, it may make more sense to talk about influences and strategies rather than causes. An appropriate analogy may be poker. The game is based on random chance, and yet some individuals are able to navigate that randomness to win more than others, and do so to a degree that partially overcomes that randomness. The Innovation Cycle is a strategy that appears to provide that kind of advantage with regard to innovation and entrepreneurship.

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