WRAYS ignite

The intelligent approach to strategic innovation

RESEARCH BRIEF

FEBRUARY 2017

Introduction

Wrays Ignite is a bundle of strategic innovation and IP services, combing the highly efficient and proven data science driven method for business model simulation from Growth Science outlined below with strategic innovation services. This proven method with impressive results enables Australian companies to be proactive and ahead of the disruption curve. Wrays Ignite will allow you to efficiently and accurately evaluate strategic options and the potential for new innovative products and services.

This Research Brief outlines the background, methodology and results of the data science based approach developed by our partner Growth Science. The Growth Science algorithms and methodology are the result of a breakthrough research collaboration between Thomas Thurston and Professor Clay Christensen of Harvard.

Given enough data, technology and math, it's possible to model social systems and produce accurate predictions.

Results

Historically, only 20% - 30% of new growth initiatives survive their first 10 years. This low survival rate persists with small and micro-businesses, start-ups, corporate innovations and acquisitions. Therefore any model that can consistently predict the results of internal growth investments with greater than 30% accuracy, over the same timeframe, holds potential to be useful for executives, managers and other innovation practitioners in a corporate setting.

Growth Science's methodologies ('models') have produced thousands of forward-looking predictions about the likely success or failure of early-stage corporate innovations, acquisitions and venture capital investments within a 10 year timeframes. Of these predictions, more than 4,000 have "matured" (the results are known) while others continue to await maturity. Among the 4,000+ mature predictions, as of the most recent data refresh 67% of those predicted (by the models) to succeed did, in fact, succeed. Meanwhile 86% of predicted failures resulted in actual failed initiatives. When both survival and failure predictions are combined, the total gross accuracy of the models was 81%.

These predictions were requested of Growth Science's models randomly, by corporations, colleagues and investors. Growth Science did not get to "pick and choose" its dataset.

Predictions were done serially, using mechanical processes without the benefit (or detriment) of personal preference, human bias or intuitive judgement. The 4,000+ predictions represent the sum total of all mature predictions generated by the models to date (the whole dataset), not a sub- section of the data.

While the models are probabilistic, all predictions were engineered to produce deterministic outcomes (emulating real-life realities) rather than purely stochastic conclusions. In other words, the models are based in probabilities but ultimately culminate in a "yes" or a "no." That said, their stochastic foundation makes them directly applicable and valuable in the context of portfolio management. Furthermore, it's worth reiterating that the 4,000+ predictions were forward-looking, real-time predictions, not a back test or best-fitted with the benefit of hindsight.

The results reveal strong statistically significant correlations with high confidence levels. A basic Chi-squared test generates a result that is significant at $p < 0.01$ (more than 99% statistical confidence).

$$X^2 = \sum \frac{(o-e)^2}{e}$$

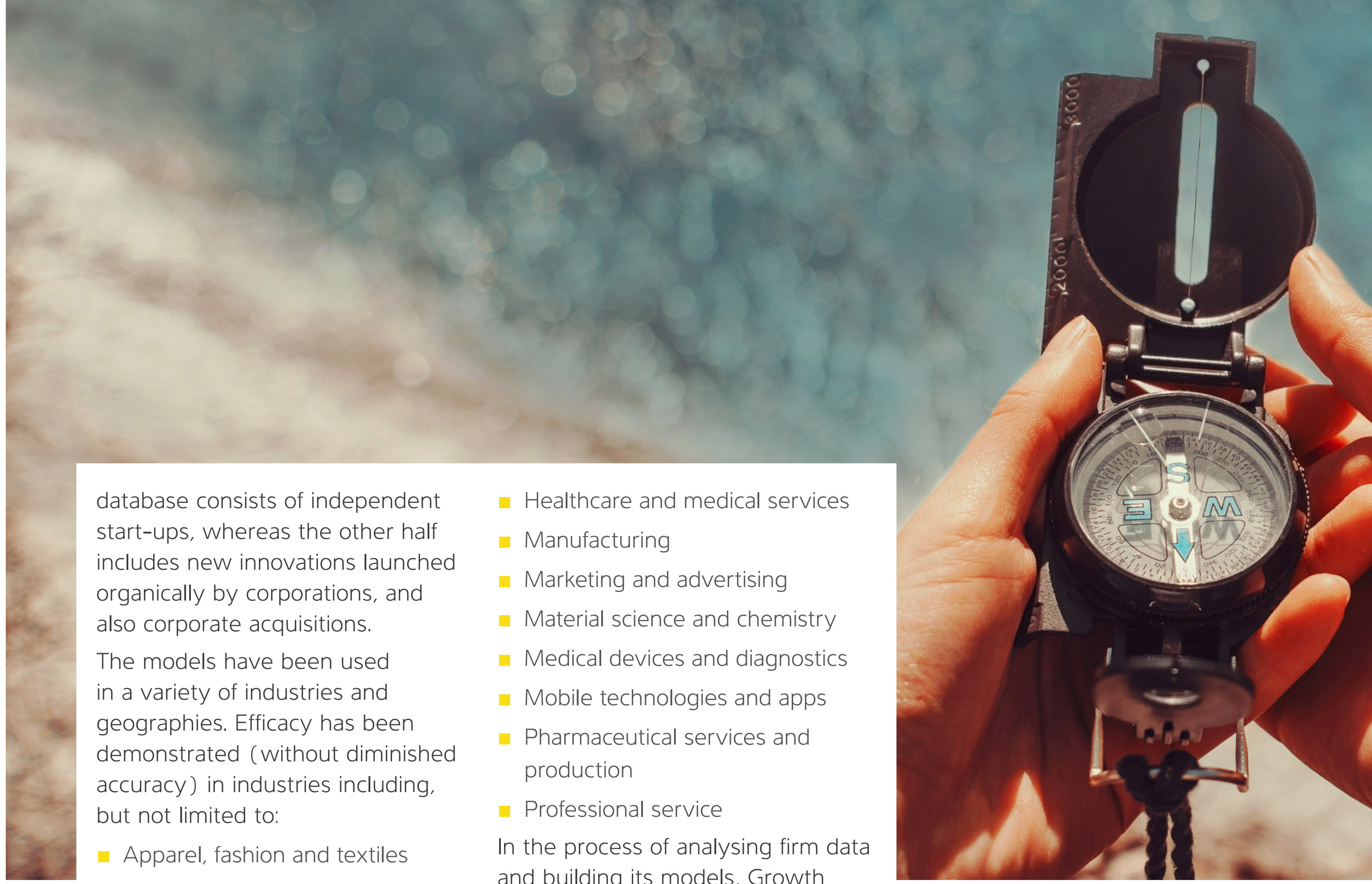
A more granular goodness-of-fit analysis, such as a two-tailed Fisher's exact test of independence, produces a P value of less than 0.0001 (99.99% statistical confidence). In other words, there is less than one chance in 10,000 that the results were produced by random chance.

$$p = \frac{\binom{a+b}{a}\binom{c+d}{c}}{\binom{n}{a+c}} = \frac{(a+b)!\,(c+d)!\,(a+c)!\,(b+d)!}{a!\,b!\,c!\,d!\,n!}$$

	Actual Survival	Actual Failure	Prediction Type Totals
Predicted Survival	67%	33%	100%
Predicted Failure	14%	86%	100%

Predictions were correct
Predictions were incorrect

Methodologies



Growth Science relies on three main analytical techniques:

- **Latent Class Modelling:**

  In statistics, a latent class model (LCM) uses latent or "hidden" variables, as opposed to observable variables, to estimate the probabilities of varied outcomes. Latent variables are not directly observed, but are inferred (mathematically) from other variables that are observed. Latent variables can sometimes be measurable, but can also be abstract concepts such as categories or behaviours. In other words, LCM allows large numbers of observable variables to be aggregated in a model to represent an underlying concept for prediction or risk assessment purposes. For example, a doctor may not be able to diagnose a disease directly (ex. if a diagnostic kit isn't available), but can estimate the probability of the disease in a patient by measuring the patient's symptoms and comparing them with other patients, to make a probability statement about the existence of the disease. "There's an 80% chance you have a sinus infection." LCM is used in many disciplines including medicine, physics, machine learning, artificial intelligence, bioinformatics and econometrics.

- **Data Mining:**

  Data mining is an interdisciplinary field in computer science for discovering patterns in large data sets. Growth Science uses data mining to both harvest data used in its analyses, and also to identify insights within that data. Data is mined from multiple digital sources such as web semantics, social media, blogs, press releases, academic journals, patent databases and other sources relevant to predictions generated by Growth Science's models.

- **Microscale Modelling:**

  Microscale Modelling (MSM) is a class of computational models that can simultaneously simulate the behaviour of individual actors and the larger groups they belong to. MSM often combines elements of game theory, complex systems, emergence, computational programming and evolutionary programming. By simulating interactions between many parts of a system, as well as the system as a whole, MSM is capable of re-creating and predicting complex phenomena. MSM offers unique insights in modelling systems with high degrees of randomness and heterogeneity where the "parts" operate autonomously from the "whole," yet both influence each other in profound ways. It is also helpful for modelling how systems evolve and mutate over time, allowing for fluid, dynamic analyses rather than static snapshots. For example, microscale models were used by Alan Turing to better understand nonlinearities in biological systems.

Growth Science has access to over 1,000 electronic data sources and has mined more than 10 billion data points since 2008. A single prediction typically involves mining between 1,000 - 15 million data points. These data are then simulated involving more than 24,000 possible outcomes before the highest probability result is converged on. While using data from multiple sources, also benefits from one of the world's largest and richest proprietary databases of corporate growth efforts worldwide. Approximately half of its proprietary database consists of independent start-ups, whereas the other half includes new innovations launched organically by corporations, and also corporate acquisitions.

The models have been used in a variety of industries and geographies. Efficacy has been demonstrated (without diminished accuracy) in industries including, but not limited to:

- Apparel, fashion and textiles
- Banking, insurance and financial services
- Communications hardware, software and services
- Consumer and enterprise software
- Consumer products and services
- Electronic components, systems and computing
- Energy and transportation
- Entertainment and media
- Food and agriculture
- Government contracting and defence
- Healthcare and medical services
- Manufacturing
- Marketing and advertising
- Material science and chemistry
- Medical devices and diagnostics
- Mobile technologies and apps
- Pharmaceutical services and production
- Professional service

In the process of analysing firm data and building its models, Growth Science has revealed numerous critical empirical observations, counter-intuitive lessons about innovation, rare statistical understandings of firm and market behaviour, and unique quantified insights into what works (and what doesn't) amongst the world's leading innovative firms, processes and best practices.

Limitations

Two primary circumstances have emerged where the models show no greater accuracy than what could be achieved through random chance. These circumstances where the models "do not work" include:

- **Innovations where unusual levels of technical risk override all other variables in an extreme, binary, and deterministic manner.**

  This is the case when technical risk (ex. will the product work or not) overrides all other factors such as execution risk, business model risk, market risk, economic risk or any other variables, to an atypical degree. For example, in the case of oil and gas exploration, the absence or presence of oil beneath the ground is an overriding variable when predicting the effort's success. If there's oil under the ground, the exploration will succeed. If there's no oil, it will fail. In such cases where technical risk (ex. the absence or presence of oil) is overriding, binary, and deterministic, Growth Science's models are not useful. Similarly, with many pure-play biotech innovations, technical risk (ex. whether the molecule cures cancer or not) can dominate the outcome. If the drug cures cancer, the firm will likely succeed. If not, the opposite is true. It should be noted that technical risk is a key part of almost all innovation efforts, however it only impacts Growth Science's accuracy in rare and extreme cases. No statistically significant differences have been found across the vast majority of industries, even those involving high levels of technical risk (healthcare and surgical devices, semiconductors, material sciences, pharmaceutical services, etc.).

- **Markets that are entirely state-controlled. Growth Science's models are only accurate to the extent that markets are, at least, minimally competitive.**

  For example, the models tend to be highly accurate in geographic markets such as the US and Western Europe, India, China, Latin America, South Korea, Taiwan, Australia and New Zealand. However decreased accuracy has been found in some sub-segments of Chinese markets and some in Eastern Europe. While no sincere modelling has been done in North Korea, Growth Science's models are likely to have no predictive accuracy there. The models don't work when firm survival or failure has no relationship to firm competitiveness.

History

Growth Science is based on the research of Thomas Thurston, part of a year-long research effort at the Harvard Business School with Professor Clayton Christensen and the Intel Corporation.

The research involved searching for quantitative patterns to better predict when new businesses or initiatives would survive or fail, and patterns began to emerge that were consistent with Professor Clayton Christensen's acclaimed Disruption Theory.

The Growth Science process has been used by Fortune 500 firms including Intel, 3M and Cray (the world's leading supercomputing company). Collectively, Growth Science's methodologies have informed billions of dollars in growth efforts worldwide.

Further information

Wrays Ignite is available as a bundle of strategic services to help you. To find out more and understand how it might be applied to your business please contact:

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This research was conducted by Growth Science in August 2016. Growth Science is a data science firm that helps executives to risk-manage organic innovation, M&A and venture capital portfolios.

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