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Understanding the failure to understand New Product Development failures: Mitigating the uncertainty associated with innovating new products by combining scenario planning and forecasting

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ABSTRACT

In this paper we show that New Product Development (NPD) is subject to fundamental uncertainty that is both epistemic and ontic in nature. We argue that this uncertainty cannot be mitigated using forecasting techniques exclusively, because these are most useful in circumstances characteristic of probabilistic risk, as distinct from non-probabilistic uncertainty. We show that the mitigation of uncertainty in relation to NPD requires techniques able to take account of the socio-economic factors that can combine to cause present assumptions about future demand conditions to be incorrect. This can be achieved through an Intuitive Logics (IL) scenario planning process designed specifically to mitigate uncertainty associated with NPD by incorporating insights from both quantitative modelling alongside consideration of political, social, technological and legal factors, as-well-as stakeholder motivations that are central to successful NPD. In this paper we therefore achieve three objectives: 1) identify the aspects of the current IL process salient to mitigating the uncertainty of NPD; 2) show how advances in diffusion modelling can be used to identify the social-network and contagion effects that lead to a product's full diffusion; and 3) show how the IL process can be further enhanced to facilitate detailed consideration of the factors enabling and inhibiting initial market-acceptance, and then the forecasted full diffusion of a considered new product. We provide a step-by-step guide to the implementation of this adapted IL scenario planning process designed specifically to mitigate uncertainty in relation to NPD.

1. Introduction

Much research has sought to identify the factors associated with successful NPD. Yet, despite this, NPD success rates remain stable and there is little evidence of reduced failure (Ottum and Moore, 1997; Page, 1993). This suggests a continued failure to adequately understand NPD failure, as a result of which reducing high rates of NPD failure remains 'one of the greatest challenges of new product research' (Markovitch et al., 2015). While acknowledgement of the difficulties associated with NPD, as-well-as the high prevalence of failure, is not entirely absent from the literature (e.g. see Borgianni et al., 2013), the tendency to focus on successful NPD, thereby giving little consideration to the factors that inhibit or prevent success, is likely to be a central factor driving continued high NPD failure rates.

As consumers we are under the influence of survival bias, which makes it appear that NPD is subject to less uncertainty than high-failure rates imply it really is (Ormerod, 2005). This uncertainty is most pronounced in relation to radically new products for which no market has previously existed (Cooper, 2000); however, even incremental enhancement of already-existing products is fraught with uncertainty. In the 1980s Coca-Cola created an 'improved' version of their standard product, which they called 'New Coke' (Dubow and Childs, 1998; Schindler, 1992). Despite it being an incremental development of an already-existing product, it was a failure. In the 1990s McDonalds made a similar, expensive mistake in the form of its 'Arch Deluxe' burger (Kleijnen et al., 2009). Uncertainty, then, surrounds the development of even incrementally-improved products; the development of an entirely new product is therefore subject to uncertainty of a still more fundamental nature.

There are two sources of uncertainty associated with NPD: epistemic and ontic. The first relates to the aforementioned survival bias, whereby the many products that surround us are those which were successfully introduced to the market. But these successes represent the tip of the iceberg of all NPD; that part which we do not see represents by far the majority: the new products that fail. This unobserved failure is central to understanding the difficulty in making inferences about NPD success and failure.

The observable evidence, analysed to estimate the drivers of product diffusion, refers to new products that, being successful, are systematically different from those unobserved, that failed. Estimating the underlying

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causes and time profiles of NPD failures based on evidence from NPD successes is therefore prone to a very high risk of misidentification, leading to many potential sources of bias in the estimates. In practice, an econometric estimation of the key drivers of the stochastic diffusion process of NPD is therefore inevitably exposed to a critical *selection bias*, due to the unobservability of the counterfactual process, whereby under different values of the key explanatory variables, failed new products would have successfully diffused into the market. This represents an epistemic source of uncertainty in relation to NPD — one that is associated with our inability to observe the counterfactual of product failure, leading to inaccurate modelling. Because of this epistemic uncertainty, inferences achieved through the application of probabilistic modelling, such as in diffusion models, have limited efficacy in reducing failure rates in relation to NPD.

However, even if this epistemic uncertainty were not present, NPD would, anyway, still be subject to a more fundamental uncertainty that is ontic in nature, and which further dilutes the efficacy of probabilistic methods of inferencing in relation to NPD. By 'ontic uncertainty' we do *not* mean the uncertainty associated with natural variability (Hacking, 2006; Hoffman and Hammonds, 1994; Maier et al., 2016), rather, we use 'ontic uncertainty' to refer to the change in the nature of reality that is brought about by a successful new product. This ontic uncertainty stems from what the economist Shackle (1938, 1943, 1949a,b,c,d, 1950–1951, 1952, 1953, 1955a,b, 1958, 1961, 1970, 1972, 1979, 1980, 1983, 1984) refers to as the 'crucial' nature of some types of decision making. Decisions of these types – 'crucial decisions' (Shackle, 1955a, 1961) – change the very circumstances in which the decision is taken in the first place, such that no future decision can ever be made in the same circumstances again (Basili and Zappia, 2009, 2010; Zappia, 2014). Essentially, such decisions, because they change the nature of reality, disrupt the very forecasts that may have given rise to the decision in the first place, exacerbating uncertainty by fundamentally, and permanently, altering the strategic landscape in which the decision was taken. They lead to cascades of responding decisions, made by others, which further disrupt the strategic landscape, leading to a high level of indeterminism, and resulting in the non-stationarity that econometric models are usually only able to estimate a-posteriori, hence with no specific NPD forecasting value.

Mainstream decision theory, associated with Savage (1954) and de Finetti (1937, 1974), deals badly with this strategic landscape-changing tendency of NPD. In mainstream decision-theoretic terminology, crucial decisions introduce a new state of nature, or delete an existing one, and both these possibilities had a zero prior probability and were therefore entirely *unexpected*. From this perspective, the emergence of a new state of nature, or the unexpected disappearance of an existing one, would require the reassessment of measurable probabilities over all the elements of the, now modified, event space. Importantly, the zero prior probabilities of the newly-introduced or eliminated state of nature have a key destabilizing feature for the application of traditional decision theory: a Bayesian update of the new relevant evidence would still return a zero posterior probability, notwithstanding the new evidence about the new state of nature. For this reason, even within an orthodox decision-theoretic framework based on subjective probability (Savage, 1954), probabilistic inference remains of limited applicability in relation to NPD.

These problems affect both probabilistic inferencing methods that employ 'objective' and 'subjective' probabilities. In the first instance, our inability to observe product failure negates the possibility of creating objective probability distributions to allow for accurate estimation using econometric modelling. In the second instance, the tendency for new products, whether successful or not, to alter the nature of reality that gave rise to them in the first place limits the efficacy of subjective probabilities as a means for NPD decision making. In this paper, we show that what is therefore required are techniques designed specifically for decision making under circumstances of fundamental, non-probabilistic uncertainty which can be *informed* by forecasting.

To deal with the fundamental uncertainty of 'crucial decisions' of the sort NPD generates, Shackle (1955a, 1961) set out Potential Surprise Theory (PST). PST has been shown to be in 'essential unity' with scenario planning (Derbyshire, 2016a; Jefferson, 2014), as originated by RAND and popularised by Royal Dutch Shell (Bradfield et al., 2005). The currently most commonly-applied format for scenario planning is that known as Intuitive Logics (IL) (Wright and Cairns, 2011; Wright et al., 2013). IL is a narrative-based approach to decision making which allows for consideration of the effect of political, economic, social, technological, environmental and legal factors on the decision to be made. Importantly for our argument, while it is a qualitative technique, it allows for input from formal, quantitative modelling. However, because scenario planning recognises probabilistic approaches to be of limited efficacy in the face of fundamental uncertainty, IL in its standard format is a plausibility-based approach, designed to overcome the problems related to uncertainty that we have outlined above (Derbyshire, 2016a). Moreover, IL recognises that humans have a degree of agency in shaping a desirable future which is as yet undetermined (Cantamessa, 2016; Derbyshire, 2016a). In this paper, we set out an adapted Intuitive Logics scenario planning approach designed specifically to mitigate the uncertainty of NPD by combining insights from the qualitative analysis of driving forces with those from model-based forecasting.

The plan for this paper is as follows. In Section 2 we show why decisions related to NPD are subject to fundamental, non-probabilistic uncertainty. In Section 3 we show why scenario planning and forecasting should be viewed as complementary, rather than the alternatives they have come to be seen as. In Section 4 we show how scenario planning in its 'standard' IL format already includes many aspects useful to mitigating the uncertainty of NPD. In Section 5 we firstly highlight the usefulness of simple forecasting techniques for identifying the 'predetermined elements' in a standard IL scenario planning process focused on NPD, before going on to outline the role of more advanced forecasting techniques, capable of identifying network and other social effects, in an enhanced NPD scenario process. In Section 6 we propose a new scenario process specifically designed to mitigate uncertainty in relation to NPD by listing the adaptations to standard IL that would be required to further enhance its efficacy for this purpose. We conclude by arguing for the suitability of this augmented scenario-planning approach for mitigating uncertainty specifically in relation to NPD.

2. NPD as a 'crucial decision'

2.1. The nature of probabilistic risk

The economist Shackle (1955a, 1961) distinguished between 'crucial decisions' subject to fundamental uncertainty, and more mundane decisions subject to risk, by firstly identifying the nature of the latter. Then, having clearly set out its opposite, Shackle was able to accurately characterise a number of important problems with crucial decisions, central among which is the lack of efficacy of probabilistic methods when facing them (Derbyshire, 2016a).

Shackle's (1955a) simple, but revealing, example of coin-tossing provides us with useful information about the future (i.e. about future coin-tosses), but this can only be accrued by dividing the problem into a series of experiments (i.e. individual tosses) and then aggregating across different categories of outcome, which is possible since the problem is a 'divisible' one, and all possible outcomes (i.e. either heads or tails) are known in advance. Obviously, if we toss a fair coin one thousand times the resulting probability distribution shows the coin to land with heads facing upwards about 50% of the time, and tails about 50% of the time. We know, then, that if we were to conduct a similar experiment of another thousand tosses, we would get approximately the same result and, furthermore, we know the probability of each possible outcome (i.e. heads or tails) for the next individual instance (i.e. the next toss). Knowledge achieved by aggregating across instances of the same type in this way is therefore useful in relation to the future — it