International Journal of Forecasting 30 (2014) 1082–1097

Contents lists available at ScienceDirect

International Journal of Forecasting

journal homepage: www.elsevier.com/locate/ijforecast

Review

The challenges of pre-launch forecasting of adoption time series for new durable products

Paul Goodwin *, Sheik Meeran, Karima Dyussekeneva

School of Management, University of Bath, Bath, BA2 7AY, United Kingdom

ARTICLE INFO

Keywords:
New product forecasting
Judgment
Diffusion models
Choice models

ABSTRACT

The successful introduction of new durable products plays an important part in helping companies to stay ahead of their competitors. Decisions relating to these products can be improved by the availability of reliable pre-launch forecasts of their adoption time series. However, producing such forecasts is a difficult, complex and challenging task, mainly because of the non-availability of past time series data relating to the product, and the multiple factors that can affect adoptions, such as customer heterogeneity, macroeconomic conditions following the product launch, and technological developments which may lead to the product's premature obsolescence. This paper provides a critical review of the literature to examine what it can tell us about the relative effectiveness of three fundamental approaches to filling the data void : (i) management judgment, (ii) the analysis of judgments by potential customers, and (iii) formal models of the diffusion process. It then shows that the task of producing pre-launch time series forecasts of adoption levels involves a set of sub-tasks, which all involve either quantitative estimation or choice, and argues that the different natures of these tasks mean that the forecasts are unlikely to be accurate if a single method is employed. Nevertheless, formal models should be at the core of the forecasting process, rather than unstructured judgment. Gaps in the literature are identified, and the paper concludes by suggesting a research agenda so as to indicate where future research efforts might be employed most profitably.

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* Corresponding author. Tel.: +44 0 1225 383594; fax: +44 0 1225 386473.
E-mail address: mnspg@bath.ac.uk (P. Goodwin).

http://dx.doi.org/10.1016/j.ijforecast.2014.08.009
0169-2070/

1. Introduction

The introduction of new products is crucial to the success and survival of many companies. However, forecasting whether or not new products will be successful is one of the most difficult tasks managers face (Wind, Mahajan, & Cardozo, 1981), and there can be huge costs associated with failed products. The forecasting of demand for new products is therefore a critical activity, and it is not surprising that large numbers of methods have been developed for producing these forecasts. Indeed, by the mid 1980s, Assmus (1984) found the number of methods to be too great for them all to be included in his review paper, and many new techniques have been developed in the intervening years. The forecasts produced by these methods can be used to guide both decisions made during the product development stages and go/no-go decisions as to whether or not to launch a developed product. They can also assist in capacity planning for the production of the product, and decisions relating to its distribution to consumers.

Forecasts can be made for either adoption levels or sales. The adoption level refers to the number of customers who have purchased one or more units of a product. The sales level refers to the actual number of units purchased, and includes not only the initial purchase but also multiple and repeat purchases, as well as purchases made to replace units bought in earlier periods. Sometimes forecasts are made for the total adoption or sales level that a product will achieve over a given time duration of '*n*' periods, or within its entire lifetime. Forecasts can also be made either prior to the launch of a product or after the first few sales or adoption levels have been observed.

This paper focuses on one particular forecasting task: the production of pre-launch forecasts of the *adoption* time series for new durable products (i.e., the period-by-period adoption of a new product over *n* future periods).[1] The difference between sales and adoptions is likely to be less important for durable products than for non-durables, particularly in the crucial early years of a product's life. In order to keep the review tractable, we do not provide an in-depth consideration of the literature on multiple generations of products where the 'new' product is merely an enhanced version of a previous offering.

This paper asks what the extant literature can tell us about the way in which such forecasts should be made, and identifies future directions for research in this area. Forecasts of adoption time series can be important where new products are concerned. Investment appraisal techniques that might be applied to new products, such as the net present value (NPV) or the internal rate of return (IRR), depend on period-by-period estimates of future cash flows. Capacity planning decisions require estimates of the size of future peaks in adoption, and of when these are likely to occur. A period when adoption levels are starting to decline may be a signal that a new generation of the product should be available by this time. Similarly, low adoption levels in the early periods of a product's life may be tolerated when forecasts for later periods show that a take-off in adoption levels can be expected (Golder & Tellis, 2004).

Despite the large number of methods referred to by Assmus (1984), most new product forecasting methods for the adoption of durable products fall into at least one of three general categories: (i) management judgment, (ii) analysis of judgments made by potential customers and (iii) formal models, which may involve fitting mathematical models to time series of analogous products launched in earlier periods, or may employ methods such as system dynamics (Peres, Muller, & Mahajan, 2010). (Other methods like test marketing tend to be more suitable for non-durables.) We argue that all of these approaches are likely to be inadequate on their own, and that an approach employing multiple methods is necessary.

The paper is structured as follows. We begin by examining the new product time series forecasting task, then discuss the methods that are commonly considered to be good candidates for carrying out the task. Next, we decompose the task into a series of sub-tasks and assess how useful each method is in the context of that sub-task, according to research and the strength of the evidence in support of these assessments. Finally, we suggest possible future areas where additional research might lead to improved forecasting.

2. The time series forecasting task

New product forecasting involves substantial risks, so ideally, the task will involve identifying a probability

[1] By time series forecasts, we refer to the forecasting of the future period-by-period sequence of a new product's adoption. This can be carried out in a variety of ways, including both management judgment and statistical methods. This should be distinguished from the term 'time series forecasting methods', which refers exclusively to a range of statistical methods, such as Box–Jenkins and exponential smoothing.