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Forecasting the Decline  
of  
Superseded Technologies:

A comparison of alternative methods to forecast the  
decline phase of technologies

A thesis presented in partial fulfilment  
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# Abstract

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An understanding of the economic life of technologies is important for firms, as new technological diffusion often results in rapid erosion of the market value of a firm's existing technological investments. Little is known about the decline of an older incumbent technology, despite significant effort has been devoted to studying the diffusion of new technologies over the last five decades. There is, it appears, a *pro-innovation bias* (Rogers, 1995), as theory has a singular focus on the growth side of the substitution phenomenon.

Yet to a modern enterprise managing the decline of the older technology may be at least as important as managing the diffusion of the new technology. Consequently, this research takes the first steps towards addressing this gap by investigating how best to predict the decline of an incumbent technology, through an examination of the performance of well-established forecasting methods when applied to the decline phase of a technology life cycle. Interestingly, during the search for historic data it was found that decline series are both rarer than diffusion series, and short, although not as short as diffusion series.

Three studies were undertaken; the first study was a competition of four marketing science diffusion models; the Pearl logistic, Gompertz, Bass, and log-logistic models. The second study tested a pooled analogous series approach against the four models from the first study. Twenty-five decline data series were used in those two studies. The final study applied expert judgment to the task using an online panel of 250 UK managers with forecasting experience. These managers undertook expert judgmental forecasting tasks on 12 of the 25 series, split over two cue information treatments. Both absolute and comparative measures of accuracy were deployed along with measures to understand bias and variability. The measures were not always in perfect consensus as to the best models in each study; however, the results in aggregate were conclusive.

It was found that the Bass and the Pearl logistic were consistently the best marketing science models. However, the online panel of forecasting experts provided a pooled estimate that was competitive with those best marketing science models. Importantly, forecasts from presenting data on decline in tabular form to the panel outperformed the same data presented in graphical form, such that tabular presentation was better than any marketing science model. Also well performed was an analogous series model formed from the average value of a normalised pool of the 25 series, as this approach provided forecasts that were within the range of the two best

diffusion models. A straight-line model fitted to the last three data points in the estimation data constantly matched or outperformed all three methods over short horizons.

This indicates that simple diffusion models, such as a simple pooled average of available analogous series or even a straight-line model can provide a viable forecast, providing further evidence that simple methods are in general all that is needed to forecast in such situations. Despite laboratory research indicating that individuals are poor at this task, the judgmental study indicates that humans can be successfully used to forecast S-shaped curve trajectories in field trials; however, there are cost and time implications in using a panel that would preclude its use in many situations.

**References:**

Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York, NY: The Free Press.

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