

S-Curve Analysis and the Technology Life Cycle: Application in Series of Data of Articles and Patents

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Abstract

Since some years ago, business and scientific communities have tried to understand technology behavior through time as well as the strategies that could be carried out through that trajectory. An alternative for analyzing technologies through time are the S curves models (Kucharavy & De Guio, 2007), (Zartha 2009), (Perez, 2001), (Ortiz & Pedroza, 2006), (Foster, 1986) where it is possible to identify if a technology is emerging, incoming, key or base, if it is necessary to establish a monitoring strategy, selective investing or not overinvesting and determine the diffusion phases as initial diffusion, early growing, late growing and maturity of a technology.

In this document, the way a technology behaves through time is analyzed by means of S curves, taking the number of publications and patents as performance parameters.

In order to achieve the S curves of this technology, were used data series from Biotechnology and Nanotechnology articles since 1956 were obtained from ISI Web of Science and patents since 1962 (Priority Date) and 1970 (Issue Date), belonging to controlled release of the medical context and drug delivery; the data were analyzed using the software tool Vantage Point, the data were accumulated and then a non linear regressions were made applying different sigmoidal mathematical models, taking into account the statistical parameters R², t value, p value and Durbin Watson. The data series were analyzed with some models, including Weibull, Gompertz, and Logistic. A total of 13 models were analyzed, obtaining the values of the parameters for each model. After this, the inflection point of each series was calculated by means of the second derivative.

With the obtained values of the inflection points for the articles and patents series, the uncertainty in decision making on Technology Life Cycle can be reduced, particularly on the following aspects: Identification of the type of technology (before and after the inflection point), determination of the right time to apply Intellectual property and technological rights (convenience of protecting before the inflection point) and establishing monitoring strategies (when is it emerging from technology) and investing strategies (avoid overinvesting after the inflection point).

In studies related to using S curves, different phases delimited by specific points through its growing are identified. This evolution has been studied by authors like Winter (1997), Dosi (1982), Pérez (2001), among others. Ortiz and Pedroza (2006) describe the evolution of a technology and its trajectory through S curves too.

According to above, it is appropriate to analyze the technology performance by its own S curve, defined by a time series related to one or more performance parameters, identifying each phase by curve properties such as its minimum and maximum values (asymptotes) and its inflection point. In order to make that curve it is possible to use bibliometric data of the interest technology. Shu-Jung and contributors (2013) researched on patents related to LED controllers with the aim of establishing R&D strategies. In that study they accumulate the data of the patent requests in order to get a clear graph of technological development trends.

Preliminary Conclusions

With the values obtained of the inflection points for the articles and patents decisions can be made related to identifying the type of technology before and after the inflection point, before the inflection point: Emerging, incoming, key technology; after the inflection point: Declining technology. In this particular case, for the patents on biotechnology, specifically about controlled release materials, by issue date, the inflection point will be on 2016 and for patents by priority date on the same topics, the inflection point was on 2009.

An additional analysis can be done on the inflection point related to determine the proper time to apply technological rights and intellectual property mechanisms. Before the inflection point: The technological rights and intellectual property mechanisms are wielded, after the inflection point: Technical expertise and know-how are freely available, so that overrun related to protecting should be considered given new dominant designs that could enter this market.

Finally, S curves and its inflection point can help to reduce uncertainty about monitoring decisions when technology is emerging before the inflection point, or not to fall into overinvesting after the inflection point when technology is already a base technology