What we could get from S-curve

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Abstract:

The evolution of technical system is based on a primary law of TRIZ: Technical systems evolve in a way analogous to any biological system. Each system goes through four stages comparable to infancy, rapid growth, maturity and decline. TRIZ researchers has studied four primary indicators can help to estimate the position of the system on the S-curve.   So it will be a valuable tool for those who make important decisions.

Except for these four indicators, people can predict how the technology will continue to evolve through some features of each stage. According to these features, the author gives a vivid name to each stage of S-curve in order to help TRIZ beginners understanding. Separately from the perspective of market and technology, several enlightenments and suggestions are proposed. It may be helpful for the doubts during the process of improving and developing the system.

1. Introduction

Evolution in stages is a macro-level methodology aimed at mapping the maturity of an existing technical system. S-curve characterizes the whole system life cycles. There are four stages: infancy, rapid growth, maturity and decline– Figure 1. TRIZ introduces four indicators in determining where a product or system is in its evolutionary S-curve In addition, each stage has its own features. For the system in different stages, TRIZ also gives some advices for its development.
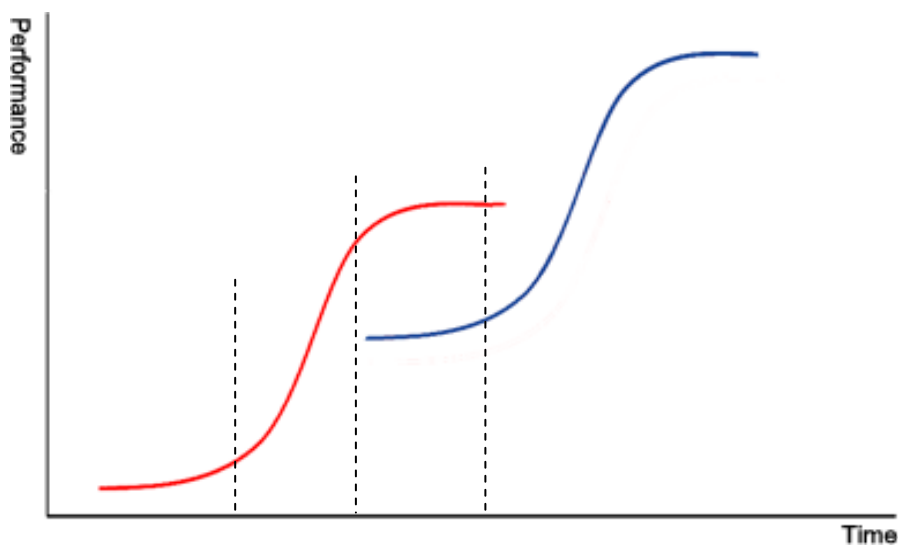

Figure 1: The S-curve of Evolution of technical system

2. Features and suggestion of each stage

1)   Infancy stage

Usually, a new system starts with a promising idea and uses many parts that come from the old system. It can provide some new functions though its main performance is worse than the old one. As a result, the new one have to resolve problems in order to work properly and work better than the old one. It often takes a long time due to the lack of resources when people are trying to improve it.

We all know such saying: You reap what you sow. However, we work much more than what we could get in this stage. So we have to be enough patient to wait for the system growth. The system is making great efforts to grow up in the first stage, so we call it "**an ugly duckling**".

2)   Rapid growth stage

Gradually, people would invest and support the improvement of the new system when recognizing its value and market potential. The system comes into the rapid growth stage. The main performance of the system grows rapidly and is becoming better and better than the old one. Meanwhile, the system is trying to enter several market segmentations where it would gain recognition of customers. The profits that the system makes increase substantially with the improvement of its main performance.

The second stage is the best one in the whole lifecycle of the system. In other words, harvest is more than pay now. So we should hold the opportunity to explore more applications of the system so that it could enter more different areas and make more profits. In this stage, the system is very popular. "The ugly duckling" is growing into "**a beautiful swan**".

3)   Maturity stage

Then, the main performance of the system is reaching its limit. Now, the system steps into its maturity stage. It is very difficult for the parameter to break through the limit because of some objective and subjective factors, such as nature limitation or some regulations made by human. Now adding more additional functions to the system is a good way to increase the whole value of the system.

In this stage the profits that the system could get from the market are still very considerable. But we should be ready for the coming decline stage. The development of the next generation of the system based some new principles should be considered now. We have to change the strategy of the system development. The system is facing renascence and jumps to the next S-curve. So the system in this stage likes "**a Fire phoenix**", splendid but will die.

4) Decline stage

When the old system is in this stage, the new generation has better main functions than the old one. The old system will be replaced and eliminated or go into some special areas, such as sports and entertainment industry where it may find new position and new supporters. The main function of the system is changed. The system likes "**an old hen**"

3. What we could get from S-curve

1) In the first stage, main efforts should be concentrated on identifying and eliminating bottlenecks that prevent the system from entering the market.

   Example: Artificial heart

   One of the main bottlenecks of artificial heart is its size. It is too big for normal people to be transplanted. It can be used only for those who are dying to keep them alive as long as possible. To make the artificial heart more widely used, it is necessary to reduce the size of implantable part and eliminate the tissue rejection. Now the size of the artificial heart has been reduced greatly in China. Its weight is in the dozens of grams range. In the near future it will enter the medical market and benefit heart patients.

2) When the new system enters the stage of Rapid Growth, it is common that its' performance is better than that of the old system that is coming into its decline stage. What should we do with the old system? Just give it up? Based on a lot of systems experiences, we could find a positive way to do with the old system, re-positioning the old one. We change the development strategy of the old system and find new position for it. The system could live longer and has its unique features in the new field.

   Example: Long play records (LP records)

   As a kind of sound and music carrier, LP records were popular almost during the whole 20th Century. But it was substituted when CD was invented and widely used from 1984. Nearly all production lines of LP records were eliminated. The price of LP fell down about 50%. But later, many music amateurs felt that CD could not provide the spacious and live sense like LP records. LP records had more and more collectors and enthusiasts again from Mid-1990s. Now its price is about 5-6 times higher than it used to be.

3) For the system in the stage of maturity, it is suggested to combine with other systems to get more useful functions. Usually the result of such combination is not just 1+1=2 but 1+1>2. It means the performance of the combined-systems is better than the sum of the performance of each system. When it is difficult for us to decide the system strategy, we can increase the performance limitation of the system by combination., The system could get more profit from such combination and live longer. Meanwhile, the system could get more time to plan the appropriate strategy adjustment.

Example：Automobile visual reversing system

Reversing often bores new drivers. Now reverse radar can help them a lot. But the radar will not help any more when there are some holes on the road. If reverse radar combines with a visual system, it will provide a clear picture of the car back. The driver can watch the picture from the small display and reverse easily. With the visual reversing system, the driver can see all back the car instead of turning round from time to time. In addition, the system could also tell the driver the distance with vocal signal.

4) Two S-curves of the system performance and market acceptance are not synchronized and have time difference. Sometimes the technology of system has been mature and advanced, but it is not accepted by market completely. In order to avoid the situation, the following notes should be considered during the R&D process.

◆ To make market research and forecast before the development of products and during R&D process. So engineers can adjust the performance of the system in time to meet the unexpected changes of market and customs requirements. In addition, it is also necessary to guide their requirements.

◆ To decide a specific market position for the product in its infancy stage. Otherwise the product would be a castle in the air and die when it comes to the market.

◆ To pay attention to the development of competitive products and correctly position our own competitive advantages at any moment. If we develop our products without looking around from time to time, we will mis-position our product in the market or miss the best time to come into the market.

Example：Concorde Airplane

Concorde airplane is the unique supersonic airliner in the world. Its speed reaches 2200 kilometers per hour, three times more than the common airliner. Its advanced technology is approved by the whole world. But the cost of the maintenance of Concorde airplane is extremely high. The ticket is also very expensive because of the high cost. The airline companies lost money in Concorde business. So the manufacturer of Concorde stops the production due to the poor sale. No Concorde airplane is flying now. It quits from the market.

5) In China, more and more enterprises are trying to introduce advanced technology and equipments into the company. They could identify the maturity degree of the introduced technology by its S-curves. It can help people to estimate the real value and make the investment with reasonable cost. Then enterprises would not buy the obsolete products with the price of new products. On the other hand, when they

introduce the latest and most advanced technology, it is also helpful to make the investment more effective in those immature technology and products by their S-curve analysis.

6) Besides four primary indicators- the number of inventions in the field, the level of those inventions, the performance of the technology, and the profitability of the technology, we can summarize other indicators according to government's policy to guide the R&D process, such as system cost, fund investment and so on.

Example: There are many kinds of fund investments for the development of system in China, including for R&D research, equipment, full production, and technical improvement, etc.. Those investments changes differently during the system development. For instance, the main investment in the first stage is for scientific research funded by government. When the system works well, the investment for technical improvement will be increased. When the system is entering the market, it is time to invest in equipments and full production. Then, the investment in R&D is always low in maturity stage.

4. Conclusion

For enterprises, using S-curve is very helpful for making R&D decision and managing development process. When we analyze S-curve of a product/system, we should consider these issues listed below:

◆ What does the S-curve of the product you concerned look like?

◆ Which stage is the product in? How to estimate it?

◆ Does the performance of the product reach its limit? Why does such limit exist? And how to increase the limit?

◆ How to shorten the time difference between the performance and market acceptance of products?

◆ When should the next S-curve be considered?

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