

# Hype Cycle of Technology Intelligence

Guenther Schuh, Katharina Apfel

**Abstract**— Technology intelligence supports the management of relevant data to seize potential chances and avoid risks in today's fast changing economy. Supported by a questionnaire-based study with industrial partners as well as experience of many years in consulting companies, the Fraunhofer IPT generated a model of the historical development of technology intelligence.

The aim is to explain the historical development of technology intelligence. Findings of this paper can be used by companies to classify their own technology intelligence status and identify which factors are relevant for this challenging task.

Based on Gartner's Hype Cycle the model was adapted to the organizational task of technology intelligence and five phases of historical development were identified. The "Trigger" phase started in the mid 80s, when technologies have been recognized as crucial strategic factors due to globalism and converging markets. Main tasks were manual searches of new technologies while a "big picture" of the company's environment and technological position was often missing. Expectations regarding technology intelligence rose steadily higher in the "Trigger" phase until reaching the phase "Peak of inflated expectations", where more resources were supplied and activities were centralized and more formalized. In addition to that the explosion of information led to a need of automation tools for the search. The third phase "Trough of disillusionment" extenuated the exaggerated expectations about technology intelligence due to over-formalized tasks, too many undirected searches and intra-organizational communication problems. The current phase "Slope of enlightenment" is characterized by the development of advanced IT-tools for scanning, the strategic alignment of technology intelligence and the aim of increasing productivity and efficiency of technology intelligence. For reaching the last, future phase "Plateau of productivity" further exploitation of IT-tools is predicted and establishing a culture of knowledge-sharing is recommended.

**Index Terms**— development phases, hype cycle, technology forecasting, technology intelligence

## I. INTRODUCTION

Technologies are more and more moving towards the center of attention in entrepreneurial decisions. This is due to their increasing significance for competitiveness in times of global acceleration of innovation cycles. To provide technologically relevant information at the right time and thereby use potential chances or avoid risks, many companies operate technology intelligence. The goal of technology intelligence is to provide the management with a basis for decision-making through gathering and processing of strategically relevant information [1].

Technology intelligence is part of the technology

management process. Regarding the topic technology management Fraunhofer Institute for Production Technology IPT is conducting studies on a regular basis to identify field-tested and successful approaches. The last study conducted from September 2013 until July 2014 was focused on the topic of technology intelligence. Next to statistical evaluations of the empirical, questionnaire-based study, that will be published individually, a representation of the historical development of technology intelligence and the perception of technology intelligence in companies has been derived. The representation is based mainly on findings from the conducted studies – especially on the one focusing on technology intelligence. In addition to that also experiences from consulting activities for many years including insights in many different companies have been incorporated. The representation has been based upon Gartner's Hype Cycle [2].

The aim of this paper is to explain the historical development of technology intelligence. It can help companies to classify their technology intelligence into this cycle to determine the own status quo. In addition to that the paper provides recommendations, which factors are important for successful technology intelligence.

In the next chapter the approach of the study is explained in more detail followed by the explanation of the different phases of the historical development of technology intelligence.

## II. ABOUT THE QUESTIONNAIRE-BASED EUROPEAN STUDY

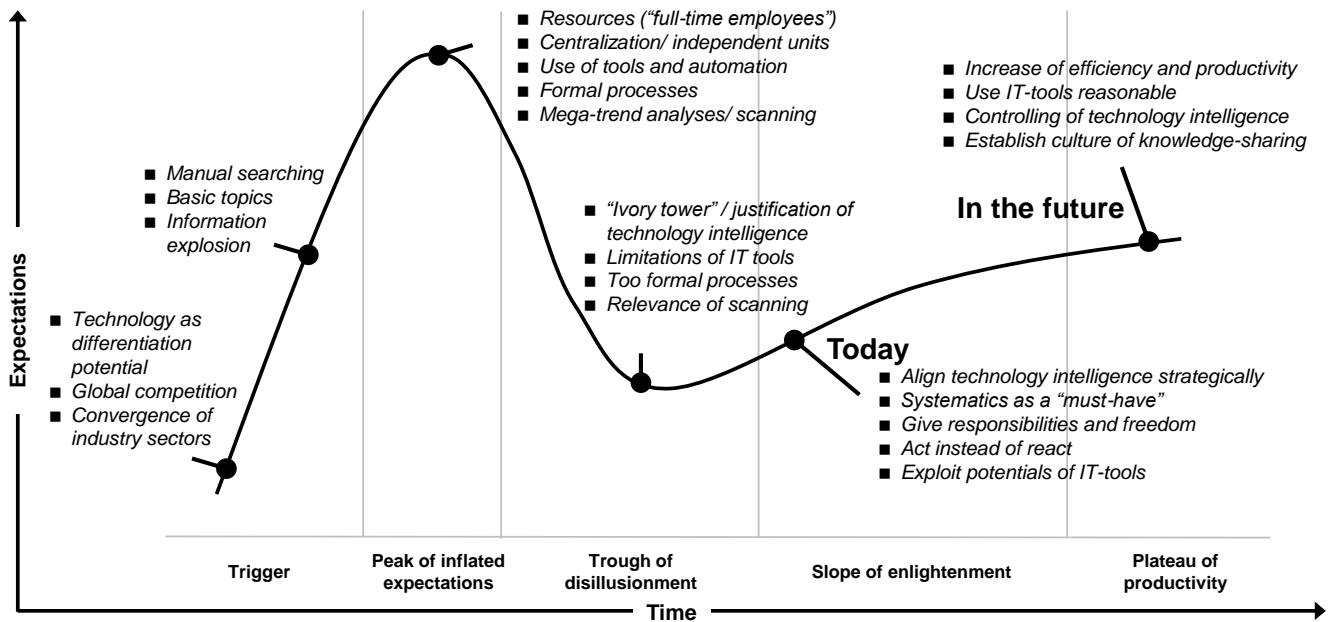
Fraunhofer IPT in Aachen, Germany, operates a department for technology management and conducts empirical studies regarding technology management. The last ones have been conducted in 2008, 2010 and 2012 with the main topic technology management but including always a part that deals with technology intelligence. In 2014 a study has been conducted with technology intelligence being the main topic. Together with a renowned consortium from industry in this Europe-wide benchmarking study particularly successfully operating companies in technology intelligence have been identified and awarded. The aim of the benchmarking study was to identify successful approaches and concepts in technology intelligence of leading European companies. The five best in class companies in technology intelligence, identified within the study, have been awarded "Successful Practices in Technology Intelligence" in 2014, namely being 3M Deutschland GmbH, Endress+Hauser AG, Enel S.p.A., OSRAM GmbH and WITTENSTEIN AG.

The approach of the study has been following: At the beginning of the study, Fraunhofer IPT and the consortium partners elaborated current challenges in technology intelligence. Based on these challenges, a questionnaire-based European study was conducted that 207 managers of leading companies participated in. The companies were asked about different facets of technology

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Prof. Dr.-Ing. Dipl.-Wirt. Ing. Guenther Schuh, Laboratory for Machine Tools and Production Engineering (WZL), RWTH Aachen, Aachen, Germany, +49241-80-2740.

Dipl.-Ing. Katharina Apfel, Fraunhofer Institute of Production Technology IPT, Aachen, Germany, +49241-8904-189.



**Figure 1: Hype cycle of technology intelligence**

intelligence. Approximately 70 % of the participants were based in Germany whereas the remaining companies were based in other European countries. These companies were asked questions related to different topics within technology intelligence. The benchmarking study focused on the process of technology intelligence, its organization, methods, tools and controlling, its linking to the strategic level as well as the assessment of technologies in early stages. Detailed interviews with potential "Successful Practice" candidates were conducted and documented in anonymized case studies, all of which were presented to the consortium partners at an interim meeting. Based on these case studies, the consortium partners chose five companies to be visited in the next selection phase. During the company visits, the chosen companies presented their approaches in technology intelligence in more detail to the consortium. Every company visit confirmed that the selected companies implemented successful approaches in technology intelligence and may rightfully be awarded as "Successful Practice in Technology Intelligence".

To compile the historical development of technology intelligence statistical evaluations of the study, findings from the interviews, the company visits and experiences from long lasting consultancy activity (more than 20 years in technology management topics) have been merged. To be able to make statements about chronological aspects also findings of the prior studies about technology management have been included. Summing up, the results explained in this paper are based on the empirical study. However the derived statements are not statistically supported but rather represent an interpretation of the findings on a very global level. The historical development of technology intelligence will subsequently be named "hype cycle of technology intelligence".

### III. HYPE CYCLE OF TECHNOLOGY INTELLIGENCE

It might seem to be unconventional to adapt a method for analyzing technology to the development of organizational

tasks in a company, in this case being technology intelligence. Gartner mentions on its website that hype cycles "are used to get educated about the promise of an emerging technology within the context of their [the clients] industry and individual appetite for risk" [2]. However, technology intelligence does not represent a technology but activities carried out in organizations (e.g. companies, institutes, ...).

When researching a way how to represent the findings of the historical development of technology intelligence it came clear that technology intelligence is undergoing almost similar phases that emerging technologies are undergoing. Due to the similarities to the different phases of the Gartner Hype Cycle the authors decided to choose this method as the representation model for the historical development and depict the findings in this kind of illustration.

The hype cycle of technology intelligence can be seen as the documentation of past phases, that technology intelligence went through and also gives future prospects towards the development of technology intelligence. The interpretation of the findings of the study show that the status quo of technology intelligence is best allocated shortly after the trough of disillusionment in the cycle. Many companies have had high expectations towards technology intelligence in the past that have not been met. In the future technology intelligence could exploit potentials and become more productive and efficient than today.

In the following chapters the five identified key phases of the history of technology intelligence are described in detail.

#### A. Trigger

On the one hand the perception of technologies as competitive advantages and on the other hand the ever increasing complexity of the environment that technology and product development face can be seen as a trigger for technology intelligence. Since the mid 1980s technologies have been recognized as strategically relevant competitive factors for companies [3] and for their *differentiation* [4]. From this point on technologies have been gaining more importance as an instrument to ensure long-term company

success [5]. Today many companies develop their technology competences further in order to survive in the competitive market.

The ever growing global market results in an increasing *global competition* that today's companies face. Due to the ever growing global competition, the market becomes more dynamic and expects better, cheaper and more innovative products continuously and in ever shorter intervals [6], [7]. This leads to an increasing complexity in the development of those products and the required technologies.

The development of a complex environment has been supported also by the increasing *convergence of industry sectors*. Products use for example not only mechanic devices but are combined with electronic and IT-devices. This makes the development of those products more complex and a company developing and/or manufacturing such products need other competences than would be necessary regarding one industry sector only.

After the trigger, technology intelligence has been identified as a possible measure to meet the above mentioned challenges. The rise of expectations towards technology intelligence began and many companies started pursuing technology intelligence activities actively. Most of the time many companies conducted technology intelligence tasks before but now started the conscious perception and clear assignment of tasks to technology intelligence. The first steps in conducting technology intelligence have been characterized by much *manual searching* of the employees. The search was conducted mainly focusing on the *basic topics* that were interesting for the company and represented a search that was more risk-oriented than chance-oriented. New topics and a broad view like a "bigger picture" have often not been included in the first searches. At this point of the hype cycle the involved employees also have been facing one of the biggest challenges in technology intelligence. Among other reasons due to the possible accessibility of a huge amount of information in the internet, the searchers experienced the *information explosion*. In the future it is predicted to become even more difficult to find relevant information due to the ever increasing knowledge creation. Manual search through such a big amount of data was expected to be easier than experienced in that period. Nevertheless, the expectation towards the performance of technology intelligence was ever increasing culminating in the peak of inflated expectations.

### B. Peak of inflated expectations

At the peak of inflated expectations technology intelligence is given attention and therefore resources. This is especially due to high expectations in the added value by technology intelligence and its results. As one aspect of this increasing attention at this time activities of technology intelligence have been partially *centralized*. This was to a large extent carried out by anchoring the activities in existing central units (e.g. corporate technology unit). In some cases also independent units have been established for technology intelligence.

In this phase also *full-time employees* have been allocated to technology intelligence, which consume their complete time for tasks in this field. They do so among other things by executing technology analyses, visiting fairs or conferences

and build up an expert network. Tasks of technology intelligence can be divided into three groups thus being scanning, monitoring and scouting [1]. Scanning means identification of weak and strong signals with the goal to have a first contact with to date unknown topics that are not in the company's focus and outside of the day-to-day business. The search is called "monitoring" when it is executed to pursue identified signals systematically and over a long-time period. Scouting however is an order related search with the goal to acquire more profound knowledge about a specific technology with the search having a very narrow focus [1].

In the phase of the peak especially the look towards the outside has been sharpened and the search was not only executed in the basic topics of the company. Due to the need of information about the company's environment the environment has been "scanned" and megatrend analyses have been executed. One result from the conducted study has been that companies that perform *megatrend analyses* systematically are less frequently surprised by new technologies they did not know before. Also regarding this topic the finding is that scanning does not mean being a random search because it needs some systematization and orientation of the search which helps to structure it.

At this point of the hype cycle also the *formalization* of processes and their anchoring has been performed. As elements that formalize the technology intelligence process search fields, search orders and dedicated budget can be mentioned. The conducted study showed that companies with explicitly defined processes and search fields are generally more satisfied with the performance of their technology intelligence.

Another new element in this development phase of technology intelligence represents the broad *use of IT-tools* for the search that was previously conducted manually. The expectations towards these tools were to automatize the search. In this period research tools (like e.g. Goldfire Innovator) have been used and tested with the goal to reduce the high efforts accruing from manual search.

Summing up the peak of inflated expectations of technology intelligence can be characterized by giving it attention and therefore budget and resources. The following decrease of the expectations in the hype cycle of technology intelligence is attributable to the fact that inflated expectations could not be met with the above described measures.

### C. Trough of disillusionment

Following the peak the development of technology intelligence has passed the trough of disillusionment. At this point the expectations of the prior period have been neutralized and the measures given at peak are perceived as exaggerated.

As an example the setting up of centralized units resulted in technology intelligence facing the *"ivory-tower"-syndrome*. Due to organizational and geographical distance from the day-to-day business, technology intelligence was not accepted by other units. This was especially inconvenient because other units should use the findings from technology intelligence and could benefit from them. In addition to that in this phase of the hype cycle the demand for quantitative

*controlling* of technology intelligence was expressed. Results are often not directly connected to technology intelligence because it takes a long way through technology development and product development until a final result in the form of a product is manufactured. Due to the hardly measurable results, justification for expenditures in technology intelligence was demanded.

In this phase, another finding has been that formalization of processes is important but that in the period of the peak *formalization* of the technology intelligence process was *over-the-top*. This resulted in problems on the operational level.

Next to issues regarding processes, expectations regarding tasks have also been exaggerated. This includes especially those about *scanning and undirected search*. The study results have shown that companies that divide their search at a ratio of 4 to 1 in directed and undirected search are particularly successful [8]. Directed search includes monitoring and scouting activities and therefore takes 80 % of the search time whereas undirected search means scanning activities e.g. through megatrend analyses.

Regarding expectations towards IT-tools it has turned out that they can support the manual search but are not yet developed that far to automatize it completely or replace manual search at all. *IT-tools are limited* for technology intelligence.

It can be stated that at the moment much development effort is channeled into this area and there is a huge potential for utilizing IT-tools in the future. But it has also become clear that IT-tools will not replace humans totally in the search of new technologies. IT-tools have the ability to collect and search through huge amounts of data but the transfer to assess technological information in the context of the company's competences and knowledge is limited and a human is of vital importance to carry out the assessment.

Summing up the great amount of attention given at the peak has been exaggerated and resulted in the trough of disillusionment where those high expectations were extenuated.

#### D. Slope of enlightenment

The findings indicate that at the moment technology intelligence is situated at the beginning of the slope of enlightenment.

Especially as a result from the study it is important to *strategically align* technology intelligence to act efficiently. Companies that have defined a technology strategy and assess technologies on the base of guidelines from technology strategy recognize technologies less coincidentally.

In addition to that there is need of a balance between *systematization and freedom*. Next to systematization that should not be too formalized, it is important that technology intelligence is given responsibility and freedom in their doing. This should support the unit to act proactively and independently.

The task of technology intelligence is understood in *acting instead of reacting*. Although its main goal is to analyze ongoing activities in the environment it can also be used to develop and promote an own picture of the future. Siemens is

shaping the technological future by publishing their magazine "Pictures of the future". Also other companies could use technology intelligence to publish their technological vision.

To improve productivity of technology intelligence, *IT-tools* should be utilized. But these tools need to be further developed especially for this purpose. For example the application of semantic search methods, automatized data analyses and self-adapting programs has only just begun but it is predicted that in the future it can support the search execution.

On the whole it is assumed that technology intelligence has become more realistic after the trough of disillusionment. In the future the goal for technology intelligence is to become more efficient and productive to reach the plateau of productivity.

#### E. Plateau of productivity

To become more efficient and productive three levers have been identified: exploiting potentials of IT-tools as well as improving controlling and cultural aspects about technology intelligence.

*Exploiting potentials of IT-tools* can mean to further develop them for the companies own purposes in order to have a competitive advantage compared to competitors. The overall goal is to build up "electronic" competence to judge information and to reduce the complexity of scanning through a huge amount of data.

Other aspects that can help reaching the plateau of productivity are *controlling* and the establishment of a *culture* supporting technology intelligence. Controlling in this context serves to make technology intelligence more efficient and to give more transparency. Sometimes technology intelligence cannot assert itself in companies because stakeholders do not see the added value. In addition to that a culture of knowledge-sharing is advantageous. Often technology intelligence is not only performed centrally but many employees are required to find relevant technological information. In this case it is important for the company that employees know who the right receiver for identified knowledge is and that they are willing to share it.

The plateau of productivity has not been reached yet but little by little it will be the next step in the development of technology intelligence - if not the goal of it.

## IV. CONCLUSION

This paper has shown a representation of the historical development of technology intelligence. After a trigger the expectations regarding technology intelligence have been rising culminating in a peak. After that peak a trough has been run through. Currently technology intelligence is located shortly after that trough and is now bound for reaching a plateau of productivity.

Summing up different measures have been taken in diverse phases that technology intelligence went through. In the beginning technology intelligence has been granted with lots of resources. After that – at the current status – technology intelligence became more realistic and is aligned more strategically, which gives it a certain focus.

As success factors for technology intelligence following have been identified: strategic alignment for the search, resources for technology intelligence, focusing on assessment instead of searching, dividing the search reasonable into directed and undirected search and supporting the search by using IT-tools.

For future research it can be interesting to observe if the predictions in this paper regarding usage of IT-tools or more intensive controlling activities are realized in order to increase productivity. Another interesting research aspect would be how to measure productivity of technology intelligence to further support the hypothesis of this paper that productivity will increase in the future.

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**Prof. Dr.-Ing. Dipl.-Wirt. Ing. Guenther Schuh** has studied mechanical engineering and economics at RWTH Aachen, Germany, where he has also achieved his PhD degree at the Laboratory for Machine Tools and Production Engineering (WZL). Following he was full professor at the university of St. Gallen, Switzerland. Currently he is head of department for production systematics at RWTH Aachen, member of the directorate of the Fraunhofer Institute for Production Technology, Aachen, and director of the Institute for Industrial Management (FIR), Aachen. He is CIRP-Fellow, member of the German Academic Society for Production Engineering (WGP) and member of different advisory boards. His research regards topics in production systematics and technology management.

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**Dipl.-Ing. Katharina Apfel** has studied mechanical engineering at RWTH Aachen, Germany, specializing in construction and development and finishing with a diploma degree. After her studies she has started working as a research associate and PhD student at Fraunhofer Institute for Production Technology in the department of technology management. Her research regards topics of R&D management and technology intelligence.

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