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Comparing technological hype cycles: Towards a theory

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ABSTRACT

The notion of 'hype' is widely used and represents a tempting way to characterize developments in technological fields. The term appears in business as well as in academic domains. Consultancy firms offer technological hype cycle models to determine the state of development of technological fields in order to facilitate strategic investment decisions. In Science, Technology and Innovation Studies the concept of hype is considered in studies on the dynamics of expectations in innovation processes, which focuses on the performative force of expectations. What is still lacking is a theory of *hype patterns* that is able to explain the different shapes of hype cycles in different contexts. In this paper we take a first step towards closing this gap by studying and comparing the results of case studies on three hypes in three different empirical domains: voice over internet protocol (VoIP), gene therapy and high-temperature superconductivity. The cases differ in terms of the type of technology and the characteristics of the application environment. We conclude that hype patterns indeed vary a lot, and that the interplay of expectations at different levels affects the ability of a field to cope with hype and disappointment.

1. Introduction

In technological fields one can often observe waves of media attention combined with high rising expectations on technological possibilities. Such expectations play an important role in the emergence of technology by guiding research activities, attracting resources and creating legitimacy [1–3]. Expectations that foresee a bright future for certain technologies might thus benefit the technological development by attracting resources and actors into the technological field. While these dynamics may favor a technology, they are not innocent: when expectations become too positive, they "[…] may present a 'source of 'overshoot' ultimately damaging credibilities and reputations" [4]. In such cases much of the earlier attracted resources may eventually appear effortless and development of new technologies is harmed. Such waves of high rising expectations can be indicated as 'hype' [5–7].

The notion of 'hype' is widely used and represents a tempting way to characterize developments in technological fields. The term appears in business as well as in science domains. The marketing literature has probably been first to recognize that high-rising expectations may amount to a hype that attracts attention, support and complementary assets, and that hypes thus influence diffusion patterns [8–10]. Consultancy firms have used this insight to offer models of technological hype cycles to determine the state of a technological field along its diffusion curve in order to provide advice on strategic investment decisions. A famous example for this is the Gartner hype cycle [11,12]. Science, Technology and Innovation Studies (STI-studies) have considered hypes in studying the dynamics of expectations in innovation processes. They share with the marketing literature the conviction that hypes are *performative*, but have delved more deeply into the complex interactions between 'hype' as a collectively shared rhetoric about an emerging technology and the underlying innovative activities [13].

While the existence of hypes is widely recognized in STI-studies, case studies on hypes have thus far remained localized, explaining specific dynamics in specific contexts. What is still missing is a theory of *hype patterns* that is able to explain the different shapes of hype cycles in different contexts. In this paper we take a first step by studying and comparing the results of three case studies on hypes in three different

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empirical domains — voice over internet protocol (VoIP), gene therapy and high-temperature superconductivity (HTS). The cases differ in terms of the type of technology and the characteristics of the application environment. The following Sections (2 and 3) review the most important concepts used for our analysis and the methodology. Section 4 discusses the cases and investigates the hype patterns. In Section 5 a comparison of the different cases is presented and Section 6 provides some general conclusions of our research.

2. Concepts of hype

In STI-studies, the role of expectations in shaping emerging technologies is widely recognized [1–3,14–16]. Expectations can be defined as "real time representations of future technological situations and capabilities" [1], and as such they provide a guiding structure in emerging technological fields. More specifically, they guide the activities of innovative actors by setting agendas; they provide legitimacy and thus help to attract financing and enroll actors; and they, while often spread through spoken and written words, may materialize in experiments and prototypes. For instance, expectations that position gene therapy as a potential cure for hereditable diseases are likely to attract both investors from pharmaceutical industry and researchers from hereditable diseases and cell biology. Such positioning is unlikely, though, to yield research activities in applying gene therapy for viral or bacterial diseases. When more and more actors share similar expectations, the promises inherent to these expectations are gradually translated into requirements, guidelines and specifications regarding the new technology [2]. In other words, they turn from more or less specified rhetorical figures into more obdurate forces that shape the evolution of an emerging technological field [2]. Innovating actors are not only compelled to join the "bandwagon" [17], but also their activities will be structured according to the specific ideas inherent to it. Expectations are thus *performative* in nature and shape the dynamics of an innovation trajectory.

The performative character of expectations has important implications for the study of hypes. In public discourses, hypes are often seen as something deceptive, incorrectly exaggerating the impact and outcome of an otherwise independent technological development [13]. In contrast to such realist readings of hypes, our perspective on hypes is futureless [18]–not interested in hypes as more or less accurate forecasts, but as collectively pursued explorations of the future that affect activities in the present. While the early and high-rising expectations that characterize hype hardly ever materialize precisely as foreseen, they structure and shape the materializations that eventually occur. A perceived gap between early expectations and eventual technological development is thus not an accurate indicator of a hype, let alone an accurate measure to distinguish a hype from a "truthful" representation of the future. In this connection, Brown and Michael [14] have proposed a different strategy and take a discourse of revolution and technological breakthrough as an indication of hype.

Hypes are usually followed by disappointment, when high expectations are not met by the actual outcome of innovative activity. Disappointment is often marked by an abrupt collapse of positive expectations [16] followed by a slow recovery in a hype-disappointment cycle [4,7]. Fig. 1 displays a stylized representation of such a cycle that is used by the Gartner group

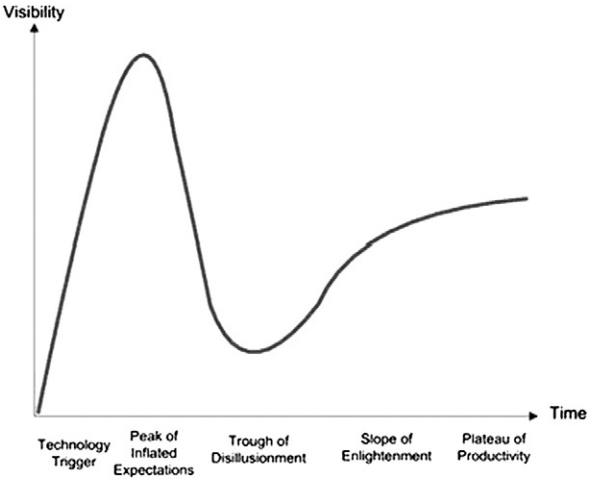

Fig. 1. The Gartner hype cycle.

[19].[1] Research on hypes has suggested that this general pattern can take many different forms, where three characterizing variables distinguish more pronounced from more diffuse hype patterns[13]:

- Hypes have a peak of very optimistic and exaggerated expectations; such a peak is anteceded and followed by more modest and mixed expectations. We consider the *shape of the peak* a first crucial variable of a hype pattern — that is, the degree of enthusiasm and unambiguity during the peak, and the swelling and slope of the peak.
- A trough of disappointment, in which the original expectations do not materialize, follows peaks. We consider the *depth of the trough* to be a second crucial variable – that is, the degree to which enthusiasm breaks down in the trough, and in how far a slow recovery takes place after the trough.
- Finally, we consider the overall *length of a hype* to be a central background variable.

These variables together describe the shape of a hype pattern. In our case analysis below (Section 5), we shall therefore focus on these variables separately to analyze how differences in the shapes of hype can be explained.

More specifically, our empirical analysis zooms in on these variables in terms of two analytical specifications that earlier literature has suggested to be influential for the shape of hype patterns. First, hypes are constituted by expectations at different levels. Van Lente [16] has distinguished between expectations at the micro level or research groups or individual firms, expectations at the meso level of the technological field and, finally, expectations at the macro level of technology in society. In other words, innovation of emerging technologies is embedded in a complex interplay of specific, functional and generic expectations [2]. Ruef and Markard [13], in their analysis of stationary fuel cells in Germany, were the first to adopt this distinction to the analysis of hypes, where they differentiated between expectations on a project level, i.e. statements regarding the outcome of a *specific project*, *generalized expectations* about a technological field, i.e. more general statements on the expected

[1] Adapted from http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp (seen on 1 December 2010).