New Ventures in Nuclear Fusion: Overview and First Evidence on Financial Parameters and Ratings

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Overview

Nuclear fusion has been a topic of intensive R&D since its inception, back in the 1930s, has received plenty of public funding, and was largely carried out in integrated, large-scale research laboratories. Interest In the topic is rising once again, and new corporate structures are observed, mainly "new ventures", i.e. companies breaking loose from their previous large-scale labs, or set up by university spin-offs. Our hypothesis, borrowed from Prof. William Nuttall (2020; 2022), and other stakeholders, which claim that significant research progress may be reached, if it is possible to demonstrate progress commensurate with the amounts of money spent. It is important to classify the technological status on its way to a possible commercialization and to understand the potential influences on the cooperative structures.

Methods

In this article, we present a unique data set of 82 ventures in 17 countries , which we analyze in terms of dynamics, financing and technological trends in this booming sector. Since technological maturation is influenced by ventures growth, we follow the work of Nuscheler, Engelen and Zara (2019) and introduce a stages model oriented on Kanzanjian and Darazin (1988) to categorize ventures maturation and analyses statisticaly the relation between funding and other socio-technical characteristics. Since there are only a couple of nuclear fusion research reactors are operational, most identified developments can be categorized after Pistner et.al. (2024) between basic and applied research. Therefore, we identified most new corporate structures for research cantered in the USA with an equal number of ventures focusing on magnetic and inertial confinement technologies.

Results

Analysis is still ongoing with respect to personal qualifications and education of the top management teams (tmt). However, we already see that there is a major accumulation point of new ventures with a total of 45 out of 80 ventures located in the Unites States of America (USA). In addition to that, 3 ventures are in Canada, 8 in Asia (Japan & China), 20 in Europe (UK, Germany, France, Finland, Sweden, Estonia, Luxemburg, Italy, and Switzerland), 2 in Australia and New Zealand and 1 in Israel. Our data shows an increase in the total number of ventures funded since 2016 as well as a strong increase in the investment amount since 2021, particularly evident in the sums in laser based ICF fusion (Figure 1). In contrast to the expectations for the financing of an advancing technology, since 2015 the average venture age (when funded) decreases as the total funding volume increases (Figure 2). Additionally, we noticed that the highest fundings are paid out by so called angel investors. When analysing funding stages, it seems as if longer existing ventures are less likely to get access to larger funding sums by venture capital companies. In contrast to that, angel investors are more likely to invest in rather established ventures. More statistical analysis will be conducted until June 2025 to achieve deeper insights.

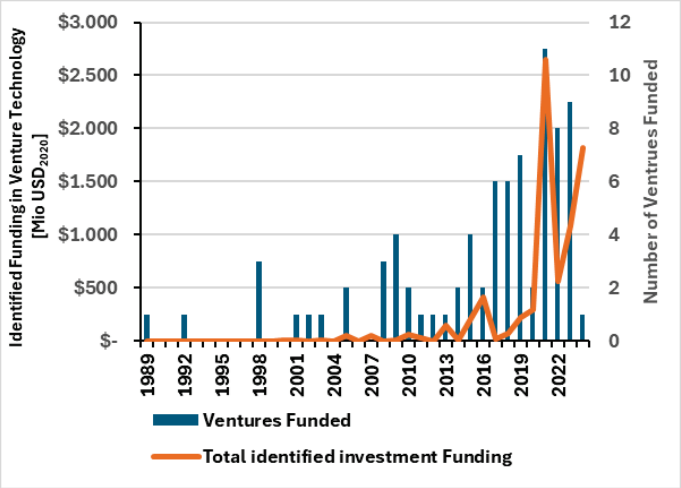
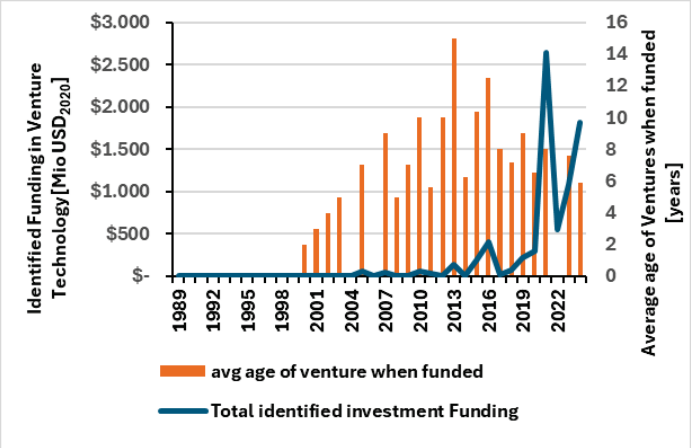


Figure 1: Total Investments in new ventures compared to number of funded ventures in a given year
Source: Own data depication based on own dataset



Fiurgure 2: *Total Investments in new ventures compared to the average total age in a given year*
Source: Own data depication based on own dataset

Conclusions

We see a very high level of private and public interest in investing in nuclear fusion. In particular, the growth of private financing and initiatives is exponential and still holds potential. At the same time, the technical progress achieved is difficult and very heterogeneous, meaning that commercial success is also uncertain in the medium term. Further statistical analyses in relation to entrepreneurship can reveal correlations for understanding the innovation process and company ageing.

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