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New Study Identifies Drivers of Scientific Research Productivity

- **Increasing complexity, short-termism and the decline of government funding threaten scientific research productivity**
- **Collaboration is a positive driver**
- **Results could be helpful in structuring projects across the spectrum of scientific research**

Darmstadt, Germany, November 10, 2021– Merck KGaA, Darmstadt, Germany, a leading science and technology company, today unveiled a representative study on scientific research productivity. Research productivity is defined in this study as the ratio of measurable input (e.g. number of researchers, financial investment) to measurable output (e.g. patents, publications). The study identified four factors that impact on research productivity in organizations worldwide:

1) **Complexity:** Science is increasingly complex: The increasing need for specialized skills, requiring larger teams, difficulty in keeping up with latest research, an increasing administrative burden and natural limits to innovation drag on research productivity.
2) **Short-termism**: The pressure to produce results in shorter timeframes is increasing and may have negative consequences for research quality and limits the focus on research into new, unexplored areas.
3) **Collaboration:** Internal and external collaboration are significant drivers of research productivity. Diversity is seen as important.
4) **Public funding:** Government support is generally seen as supportive, but funding could be more balanced in terms of research priorities (experimental,

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applied and basic research). The level of public funding as a share of total funding decreased in the countries studied between 2000 and 2018.

"Scientific research is an essential driver of economic growth and human progress as it generates a basis for innovation. So, indications from a number of well-respected economists that research productivity has declined across a range of countries concerned us. We decided to investigate whether this is true, and if so, why. This study makes an important contribution in identifying the enablers and disablers of research productivity, thereby giving us the opportunity to shape a research environment that delivers long-term impact on societal progress", Laura Matz, Chief Science and Technology Officer at Merck KGaA, Darmstadt, Germany, said.

The global forecasting and quantitative analysis specialist, Oxford Economics, Oxford, UK, conducted the study on behalf of Merck KGaA, Darmstadt, Germany, to find out whether the productivity of scientific research is actually falling – as a body of academic research suggests – and to explore the key drivers of this engine of progress[1].

"Our study shows a need for the scientific community to examine the best ways to measure the productivity of research," Adrian Cooper, CEO at Oxford Economics, said. "This should support more efficient innovation development over the long term."

Although widely cited economic studies point to a decline in research productivity, the study could not identify a clear trend. Survey respondents (from the industrial manufacturing and automotive, healthcare and high-tech sectors, as well as national research institutions) use a range of metrics used to measure productivity in their company, with no standard model. Data is publicly available on only a few – notably

[1] Components of the study: Literature search; survey of 25 economists and scientists in Asia, Europe, and the USA; expert workshop with eight R&D experts from Germany and the USA; econometric analysis to research causal relationships, statistical analysis of data from existing public sources; survey of 3,500 researchers in seven countries (USA, UK, France, Germany, China, South Korea, Japan) and five industries (health/pharma/biotech, high tech, industrial manufacturing/aerospace/automotive, chemicals/energy, and research institutes—according to OECD SIC codes) from December 2020 to January 2021.

patents (or sector-specific equivalents, such as new active ingredients in pharmaceutical research) and scientific publications.

Short-termism: Pressure to publish and shorter funding cycles weigh on productivity

73% of respondents said pressure to produce scientific results or publish papers has increased in the last ten years. At the same time, 59% said that the quality of research was suffering. Three quarters (74%) agreed that shorter funding cycles lead to less research in unexplored areas and 55% said that the lack of longer funding cycles is detrimental to research productivity.

Complexity: Specialized teams and limits of innovation take a toll

85% of survey respondents said scientific research in their field is increasingly complex. In addition, 71% of respondents find it difficult to stay up to date with the latest research in their field. The increasing need for specialized skills, requiring larger and more complex teams, was cited by 36% of respondents as one of the top three barriers to research productivity. 34% of respondents believe the innovation frontier is further away, due to the existing stock of knowledge, and this is weighing on research productivity – a view supported by some of the literature.

Collaboration: Teamwork and diversity increase productivity

49% of respondents say a high level of internal collaboration is the most important organizational driver of research productivity. Just over one third of respondents indicated that their organizations are diverse in practice in terms of age, gender identity, and research disciplines, which one third say has a positive impact on research productivity. Outsourcing is rated positively – 75% say outsourcing increased the return on research investment. In the long term, however, outsourcing could lead to a potential loss of knowledge that would improve in-house research efficiency.

Public financing: Right balance is critical

Government support is considered adequate in many areas: The majority (69%) do not see current government support as a significant barrier to productivity. However, statistical analysis shows that the proportion of government funding in total research funding has declined. This could be a problem for long-term research,

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most of which is supported by government funding. Additionally, government investment has been shown to stimulate private sector investment.

"We want to discuss these results with the scientific community, the broader ecosystem of policy makers and funders and – longer-term – the general public to evaluate how to best support scientific research productivity. We need a broad discourse to best address these far-reaching issues," Matz continued. "Factors such as collaboration and sufficient freedom are seen as conducive to the research environment. We need to look at how to promote them whilst still achieving business targets and fulfilling our social responsibility mandate," Matz explained.

The "Status of Scientific Research Productivity" study can be downloaded here.

About Oxford Economics
Oxford Economics is a leader in global forecasting and quantitative analysis. Their worldwide client base comprises more than 2,000 international corporations, financial institutions, government organizations, and universities.
Headquartered in Oxford, with offices around the world, Oxford Economics employ 400 staff, including 250 economists and analysts. Their global economic and industry models and analytical tools give them an unmatched ability to forecast external market trends and assess their economic, social, and business impact.

About Merck KGaA, Darmstadt, Germany
Merck KGaA, Darmstadt, Germany, a leading science and technology company, operates across healthcare, life science and electronics. Around 58,000 employees work to make a positive difference to millions of people's lives every day by creating more joyful and sustainable ways to live. From advancing gene editing technologies and discovering unique ways to treat the most challenging diseases to enabling the intelligence of devices – the company is everywhere. In 2020, Merck KGaA, Darmstadt, Germany, generated sales of € 17.5 billion in 66 countries.
The company holds the global rights to the name and trademark "Merck" internationally. The only exceptions are the United States and Canada, where the business sectors of Merck KGaA, Darmstadt, Germany operate as EMD Serono in healthcare, MilliporeSigma in life science, and EMD Electronics. Since its founding in 1668, scientific exploration and responsible entrepreneurship have been key to the company's technological and scientific advances. To this day, the founding family remains the majority owner of the publicly listed company.