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New Ideas and Growth: Some Policy Implications

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SUMMARY

Sustainable long-run economic growth is dependent on continuous productivity gains arising from innovation. Innovation is itself a function of the production, diffusion and application of economically useful ideas.

The characteristics of knowledge mean that the self-regulating market underproduces innovations relative to the socially optimal level. This creates a rationale for direct and indirect state intervention (e.g. R&D spending or fiscal supports) to boost knowledge production and diffusion and enhance the economy's innovative capacity.

Technology diffusion is central to the process of continuous innovation based productivity gains. Technology adoption requires an affirmative response to a number of questions. Is the potential user 'aware' of the technology? Does he/she have the 'opportunity' and the 'capacity' to acquire it? Does he/she perceive sufficient value from adoption? These questions suggest a number of potential policy levers explored in this NERI *inBrief*.

KEY POINTS

- In the long-run economic growth depends on productivity gains arising from innovation.
- Innovation is itself a function of the production, diffusion and application of economically useful new ideas
- The characteristics of knowledge imply underproduction by a self-regulating market. This creates a rationale for state intervention.
- As a priority, policymakers should focus on policies to reduce the net cost to engaging in innovation activities and on policies that enhance the quality of innovation inputs.
- However, increasing innovation 'output' is not simply a matter of increasing innovation inputs such as R&D spending. Innovation is an interative and adaptive process occuring within a complex system. Policy needs to incentivise risk taking, new thinking and collaboration.
- The ultimate impact of an innovation depends on its level of diffusion and its pervasiveness. Thus, a key task for policy is to encourage technology diffusion and adoption.

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Sources of Growth

Economic growth can come from a number of sources. It can come from the accumulation of factor inputs, namely labour and capital. It can also come from productivity gains arising from technological progress and innovation, scale economies, or efficiency of factor use.

However, the only sustainable form of growth is growth arising from productivity gains. Productivity gains come from the production, diffusion, and application of new knowledge and ideas manifesting as 'innovations' within the economy itself.

We need to define what we mean by innovation. An innovation is a new idea, or combination of existing ideas that manifests as a new product or service, a new technique or production process, a new market, a new source of supply, or even as a new organization.

New ideas

What does a new idea represent if we consider it from an economist's perspective? A new idea is basically a new set of instructions about how to interpret or transform the world in some way. We can think of a technology, for example the combustion engine, as the outcome of a set of applied ideas or sets of instructions which have been developed and improved over time through an iterative evolutionary process.

From this perspective, a subsequent improvement to the reliability, efficiency or applicability of our combustion engine can be understood as nothing more than an alteration to the set of instructions used to build or maintain the engine. Ideas and technologies will tend to successfully diffuse through the economy and society when they are economically advantageous compared to earlier ideas and technologies.

The potential for new ideas is effectively limitless with a vast number of ways to conduct any economic activity.

As it happens, the characteristics of knowledge (see Table 1) mean that the market will, left to its own devices, invest less than the socially optimal amount in knowledge generating and diffusing activities. This implies a need for activist innovation policies while leaving open the question of what precisely those policies should be.

The quality and scale of innovation inputs is important. The classic image is of people in white coats working in a lab. However, we should not think of innovation as a linear process. Nor should we think of innovation as being about the invention of new cutting- edge technologies. Instead, we should think of innovation production and diffusion as something that occurs within an economic system.

This system comprises a multitude of individuals and organizations, each with their own abilities and incentives, and each operating under a particular set of rules and constraints.

Within most countries, technology diffusion is a much more significant driver of growth than new to the world inventions. Communication is fundamental to diffusion. For this reason, the knowledge flows between individuals and organizations are crucial to the innovation process.

Governments and the 'rules of the game'

The government will always be the most significant actor within the innovation system. Governments have the power to set the 'rules of the game' and provide the incentives for market actors to engage in innovation activities.

In this way, governments can counteract the structural market failure in knowledge production as well as slow diffusion of knowledge and innovation. Governments themselves provide much of the inputs to innovation in the form of spending on science and education, on Research and Development (R&D), and on knowledge infrastructure. Governments can also provide direct or indirect support to enhance the innovative capacity of enterprises.

Table 1: Characteristics of Knowledge and Economic Implications

	Description	Implication
Non-rivalrous	One person's use need not prevent others from using the knowledge	Positive externalities in the form of technology spillovers
Inexhaustible	We can use the knowledge repeatedly. Almost zero marginal cost once obtained	Increasing returns to scale
Only partially excludable	The knowledge 'producer' may be unable to fully internalize the benefits	Reduces market incentive to invest and leads to underproduction from societal perspective
Uncertain cost of production	Outcome of investment is uncertain. No guarantee of return.	Reduces market incentive to invest and leads to underproduction from societal perspective

Table 2: Questions or 'tests' underpinning the adoption decision

	Question	Relevant Factors
A	Is the potential user '**aware**' of the technology/innovation?	Education, Experience, Physical location, Contact with existing users
B	Does the potential user have the '**opportunity**' to acquire/use the technology/innovation?	Technological constraints, Infrastructure constraints, Market constraints, Legal constraints, Physical location
C	Does the potential user have the '**capacity**' to acquire/use the technology/innovation?	Cash flow, Income, Wealth, Access to finance, Education and skill-set, Social contacts
D	What is the potential user's anticipated level of '**utility**' from the technology/innovation?	Personal preferences, Perceived relative advantage, Familiarity with similar technologies, Market opportunities

Implications

McDonnell (2018) outlines some of the main concepts and principles that policymakers can use as part of a framework for generating sustainable long-run economic growth. We can make a number of points. First, sustainable growth is dependent on continuous productivity gains arising from innovation.

Second, innovation is itself a function of the production, diffusion and application of economically useful new ideas.

Third, the characteristics of knowledge mean that the self-regulating market under-produces relative to the socially optimal level of innovations. This creates a rationale for direct (e.g. R&D spending)

and indirect (e.g. fiscal supports) state intervention to boost knowledge production and diffusion and enhance the economy's innovative capacity. As a priority policymakers should focus on policies that lower the net cost to engaging in innovation activities (e.g. broadband access) and on policies that enhance the quality of innovation inputs (e.g. investments in education and in machinery and equipment).

Fourth, increasing innovation 'output' is not simply a matter of increasing innovation 'inputs' such as spending on R&D. Innovation is an iterative and adaptive process that occurs within a complex system characterized by a multiplicity of interactions between agents and by positive and negative feedback loops.

Policymakers should ensure that the institutional environment incentivizes new thinking, collaboration and risk taking. This requires a supportive and transparent public administration; a well-functioning financial system; appropriate regulatory and legal environments; a strong education system, and cultural attitudes that embrace risk taking, do not punish failure and have an open attitude to diverse opinions and migration.

Fifth, no matter how useful an innovation is, its impact will ultimately depend on its level of diffusion and its pervasiveness within the economy. A key task for policymakers is to encourage technology diffusion and adoption. Policies that effect communication technology; proximity to other people and their ideas; education and human capital, and the economic 'rules of the game' are all likely to be relevant.

Sixth, successful technology diffusion requires a positive adoption decision (see Table 2). The potential adopter, be it an enterprise or an individual, must first be aware of the technology. In addition, the potential adopter must have the opportunity and the capacity to adopt the technology. Finally, the adoption decision depends on the perception of the utility and opportunity cost of the technology.

Conclusions

This all suggests a number of potential policy levers. We can enhance **awareness** of new technologies and innovations through a public information campaign, or by improving the knowledge flows between economic actors.

Opportunity to acquire technologies may be an issue of infrastructural or legal constraints. Policymakers have some control over these areas. Broadband is a contemporary example of a technology whose diffusion is limited in many countries due to lack of opportunity, particularly in rural areas.

Capacity to acquire the technology, sometimes called absorptive capacity, may relate to financial constraints or human capital constraints. This suggests a rationale for directly subsidizing technology adoption by small firms, and for subsidizing training and up-skilling for workers and managers.

Finally, we can increase the **perceived utility** of the technology through public information campaigns, demonstration effects, and through complementary investments in human capital

A final point is that optimal policies are context dependent. Specific policies proposals will depend on the existing industrial structure, the skill-base of the workforce, the macroeconomic climate and so on.

References

This NERI *Research inBrief* accompanies NERI Working Paper No 58 (December 2018): Innovation and Growth: Concepts and Policy Implications

Working Paper No 58 contains a list of the references and findings used in this *inBrief*.