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## Building the technological intelligence of industries and supporting organisations

Like the economies of many developing and middle-income countries, the South African economy has a fair share of innovators and globally competitive firms in many different sectors. The challenge is that there are only a few innovative companies and many lagging companies in each sector. Given the high unemployment rate and the distance from important markets, South Africa can hardly afford to be caught off-guard by technologies developed elsewhere that disrupt local industries and thin markets.

Mesopartner is working with Trade and Industry Policy Strategies (TIPS) to track and create awareness of disruptive innovation and discontinuous technological
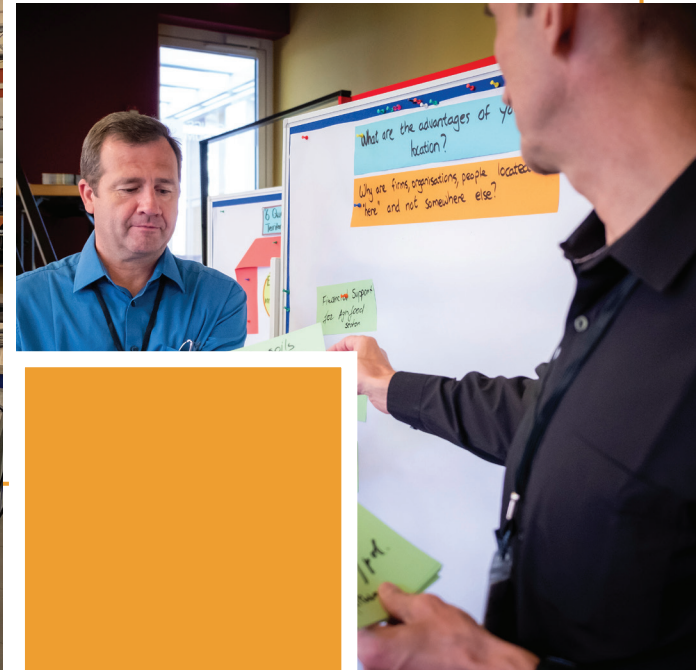
When trying to promote technological learning and innovation, we are often faced with the challenge that people in government and industry are focused narrowly on physical technologies in the form of things, machines, software code or processes. Very few workplaces pay any attention to the many social technologies needed to rearrange or adapt workplaces around new technological capabilities. Furthermore, there is little open dialogue between different stakeholders about how the gaps can be closed between industries and technological and educational institutions or how lacking technological infrastructure can be addressed.

The Observatory supports organisations in the public and private sectors by:

- Improving their integrated strategic response to global and local technological shifts
- Strengthening their role in enhancing the dynamism and resilience of the South African innovation system
- Improving coordination between organisations by supporting dialogue, joint research and information sharing
- Raising the awareness of underutilised technology capabilities in the innovation system
- Developing open data sources and analytical frameworks
- When needed, supporting public organisations to improve their analysis and measurement of technological change to enhance their service delivery to the public.

change of organisations in the public, private and not-for-profit sectors in South Africa. TIPS is a not-for-profit economic research and policy advisory organisation based in South Africa. The project is called the Technological Change and Innovation System Observatory, or the Observatory for short.

The increased media and policy attention brought about by the 4th Industrial Revolution hype was important to raise awareness of the digital divide and the changes needed in the country's skills development and infrastructure investments. However, a downside of all the hype is that many people think that technological changes will happen in the distant future, not realising that many of the emergent technologies are already here in the present.

One of the instruments we use to improve awareness of the possibilities of new technologies and the existing knowledge infrastructure is to develop Technology Intelligence profiles of the emergent technologies tracked by the World Economic Forum, UNIDO, and other organisations. While each profile must cover the basics of the technology, the focus is on the social technologies and innovations needed to harness their physical technological capability. We use the profiles in discussion with leadership teams to support them to better anticipate the possibilities for their organisation in embracing technological change. For instance, in each profile, we explore the:
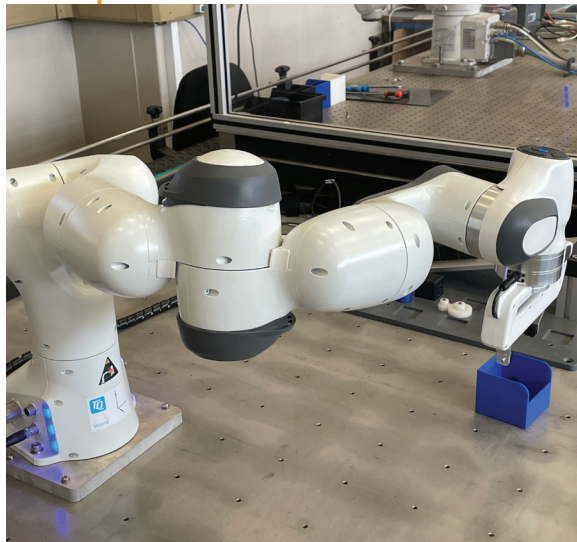
- Competence requirements: What is needed to make this technology work effectively within the organisational context? What are the new knowledge, additional skills, organisational arrangements, capital, supplier networks, additional technologies and infrastructure that need to be secured?

- Market effect: What does this new technological capability mean for markets? What expected new functions/features are being offered to the market?

- Strategic impact on the competitive position of the organisation: How will this ability influence the organisation's position, and what will it take to continue innovation if others

follow? How will the changes we make trigger change in other organisations?

- Supporting technological capability in the ecosystem: Who can we rely on for technical assistance, problem-solving, testing or other technological support? Where is there hidden or deep expertise that we can leverage?

- Anticipated regulatory adjustments: Which regulations will be required, or will already have changed elsewhere and will most likely have effects here at some point? Can we support dialogue about how regulations would have to change based on experiences in other countries and our local context?
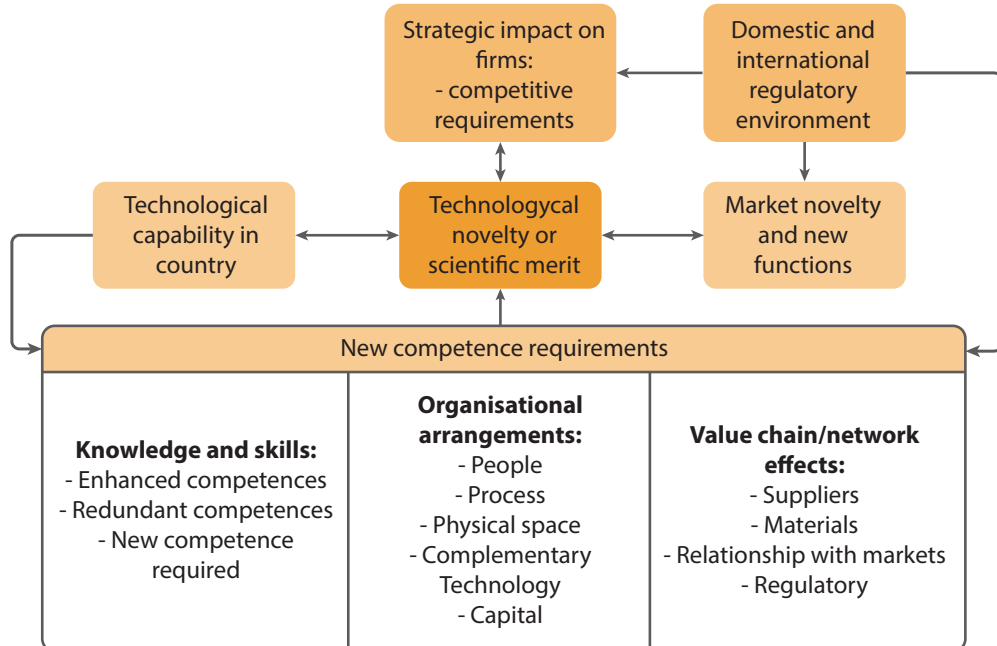
When building technological awareness, it is important to remember not to get too distracted by the features of the technology itself but to direct people to explore the effects on organisational capabilities, market structures and the other social innovations needed to make the technology easier to understand and adopt. Because it is hard to imagine how more abstract technologies (like artificial intelligence or cloud-based computing) might affect companies, more emphasis should be placed on making technology demonstration and learning-by-doing easier for businesses and public officials.

Adopting some of the emergent technologies is like learning a new language or becoming part of a new culture. Many emergent technologies are interconnected, so additional options become possible when new technologies are mastered. Because of the convergence of many digital technologies, a change in the production process of a company will likely affect many other areas of the business as well. Therefore technological upgrading is no longer a project or something done now and then. In addition, what is currently described as "emerging" is also changing the whole time. What is emerging in one sector may already be old news in another sector.

Because of the increased interconnectedness of technological domains, a small improvement in one area, for instance the battery life of small gadgets or equipment, might have many ripple effects elsewhere in companies, markets and societies. Therefore industries and government programmes must also build their shared technological intelligence. The more people there are who are looking out for technological change and innovation opportunities, the better.

Of particular importance in strengthening the technological intelligence of a company or industry is to pay attention to the ability of the leadership team both to sense and act on the required internal adjustments while at the same time being very aware of and responsive to changes in the external environment. At the same time, management teams must pay attention to required changes in the configuration and arrangements of both physical and social technologies.

David Teece[1] has argued that there are two levels of organisational competencies. The base level is operational and includes capabilities such as routine functions, administration and basic governance that allow the organisation to pursue certain activities. The higher-order competencies, what Teece calls the dynamic capabilities, include new product development, expansion into new sales regions, the assignment of product mandates across larger companies and other actions that constitute astute managerial decision-making under uncertainty. These dynamic capabilities are about being able to continuously sense and identify opportunities, being able to seize these opportunities by allocating sufficient resources and authority to internal innovation efforts and being able to transform their organisational structures around these new capabilities.

The technology profile structure (see graphic above) can also be used in a workshop setting with different stakeholders from an industry or a technology domain where the dimensions of the profile can be explored collectively.

For instance, we have used the profile with business leaders from an industry organisation wanting to increase their collective response to technologies possibilities. We have also used these headings as a guide for interviews with technology experts and managers of research laboratories or technology centres. One of the interesting side-effects of developing these profiles is that we are discovering hidden or hard-to-access technological capabilities in research programmes, training courses or private companies. As we develop each profile, we make new connections between sector associations, research organisations, technology extension centres and companies. The profiles are published on the TIPS Observatory website, but they are also re-published and shared with industry associations, research centres and the networks working with the Observatory.

For more information about the Technological Change and Innovation System Observatory, visit https://www.tips.org.za/projects/technological-change-and-innovation-system-observatory

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1   Teece, D.J. 2018. Business models and dynamic capabilities. Long Range Planning, vol. 51(1) pp. 40–49.