Summary of TNO (2020)  
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**Summary**

This position paper suggests that the key to economic recovery is innovation, pointing to post-2008 Germany as an example. Clearly outlining the facts of the current crisis, TNO (2020) explains that continuously investing in innovation in order to improve labor productivity is the best way to boost post-COVID-19 GDP growth to its desired levels since the Netherlands already has high labor participation, digitization and is facing aging population dynamics. Compared to its neighbors, Dutch investment in innovation is presented as inferior, thereby posing as a bottleneck to economic development. In addition, many Dutch R&D projects are said to not have reached the market, so emphasis is put on commercial innovation development which can yield earning in up to 4 years. Lastly, sustainability innovation projects are praised especially circular technologies, which should take advantage of re-shoring trends.

**Implications for infrastructure**   
Infrastructure should develop in line with the trends mentioned in this report, such as: R&D investment, R&D commercialization and production re-shoring. The proposed innovation is aimed at finding solutions to problems in “energy transition and sustainability; agriculture; water and food; health and care; and security (p.3).” Given the main argument of this position paper, the trend in investments in innovation can be indicative of what the post-COVID-19 economy will look like.

**Stock-and-flow diagram**

The economic crisis is most vividly represented as a decline in GDP growth, which is different from the desired GDP growth forming a gap, i.e. the central problem in the model (see Figure 1). There are a couple of control mechanisms attempting to close this gap (see Table 1). One of which are the government’s economic measures. Specifically, the measures affect the number of bankruptcies, which affects labor productivity and stalls GDP decline. Similarly, the measures reduce unemployment (at least temporarily), affecting labor force participation and thereby coming back to influence GDP growth. However, at the same time, the economic measures are increasing government debt, which only widens the gap as an ever-higher GDP growth is needed to address increasing debt.

Innovation, represented through investments in research and development, is the key idea of this position paper. More R&D can address the crisis firstly by developing a vaccine, which will address COVID-19 prevalence and thus increase labor force participation and fixing the crisis. Or, R&D can be used to develop commercial innovations thereby increasing labor productivity and fixing the crisis. These two fixes are working complementarily and the biggest difference between them is the time needed to develop either, highlighting which of these two policies would be more impactful on the ongoing crisis.

Further, commercial innovation development increases the digitization in the country, which is increasing self-reliance when it comes to technology platforms and overall economic resilience since jobs are safer from pandemic shocks when they are moved online. In this way, digitization reinforces economic resilience and has an effect of the change in GDP growth.



Figure 1. Stock-and-flow diagram based on TNO (2020). The dotted arrows are assumptions induced from the document.

Last, economic resilience is increased with the increasing trend of re-shoring, i.e. moving production jobs back to the Netherlands, thereby halting the decline in GDP. Not only that, but re-shoring is increasing the potential for innovation to restore Dutch economy as having more production at home increases the potential for engaging in material circular economies, which ultimately have the potential to boost productivity and GDP in the long run.

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| **N.** | **Page** | **Quote** | **Causal link** |
| 1 | 2 | The longer it takes before a vaccine is available, the greater the economic damage and the more difficult it will be to ‘bounce back’ out of the dip. | Vaccine development time -> Vaccine development Ongoing investment in R&D -> Vaccine development -> COVID-19 prevalence -> Labor force participation -> Change in GDP growth -> GDP growth |
| 2 | 2 | It is also entirely logical that the main focus of attention at the moment should be on using government funds to save struggling companies – and therefore people’s jobs – wherever possible. | GDP growth -> GDP gap -> Economic measures  Desired GDP growth -> GDP gap -> Economic measures |
| 3 | 2 | All of this is intended to limit the structural damage to the economy in the form of bankrupt companies and massive unemployment. | Economic measures -> Unemployment -> Labor force participation -> Change in GDP growth -> GDP growth  Economic measures -> Number of bankruptcies -> Labor force productivity -> Change in GDP growth -> GDP growth |
| 4 | 2 | Another consequence of this is the rapid increase in (collective) debt. | Economic measures -> Debt |
| 5 | 3 | It would therefore seem to be a better idea, in due course, to rebalance public finances. However, economic growth is still required in the post-corona era in order to do so. | Debt -> Desired economic growth |
| 6 | 3 | In theory, economic growth can be generated by increasing labour force participation (‘more people in work’) or by increasing labour productivity (‘creating more value per employee’). | Labor force participation -> Change in economic growth  Labor force productivity -> Change in economic growth |
| 7 | 3 | Another way of increasing labour productivity is through research and innovation. | Ongoing investments in R&D -> Commercial innovation development -> Labor productivity  Commercial innovation development time-> Commercial innovation development -> Labor productivity |
| 8 | 4 | Further digitisation of society and the business community will make the Netherlands less economically vulnerable in the event of a new pandemic in years to come, provided that the Netherlands (and Europe) do not become dependent on foreign platforms. | Commercial innovation development -> Digitization -> Self-reliance for technology use Commercial innovation development -> Digitization -> Economic resilience -> Change in GDP growth  Effect of economic resilience on Change in GDP growth -> Change in GDP growth |
| 9 | 4 | The pandemic has revealed how vulnerable and dependent the intercontinental production chains of European companies have become due to globalization | Re-shoring -> Economic resilience |
| 10 | 4 | Consequently, there is an expectation that European companies, possibly incentivised by governments, will shorten their production chains and move their production capacity and jobs back to their country of origin (re-shoring) | Re-shoring > Ongoing production  Ongoing production -> Off-shoring |
| 11 | 4 | New sustainable, circular technologies, for which few materials and energy are required, will contribute significantly to creating autonomous production. In short, besides ‘technological sovereignty’, (European) ‘production sovereignty’ could also become a feature of innovation policy. | Ongoing production -> Potential for circular material re-use -> Labor productivity -> Change in GDP growth -> GDP growth |

Table 1. Causal links found within TNO (2020)

**References**

TNO (2020) *The economy after the coronavirus vaccine: How the Netherlands can innovate its way out of the crisis.* https://www.tno.nl/en/tno-insights/articles/the-economy-after-the-corona-vaccine-how-the-netherlands-can-innovate-its-way-out-of-the-crisis*/*, accessed on 13 October 2020.