

Dutch infrastructure during and after the corona crisis:
Quick rebound or green recovery?

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Contributions position papers to the debate

Each position paper gave a specific perspective on the ‘quick recovery’ vs ‘green recovery’ debate and contributes to a more holistic overview.

- Club of Rome (2020) presents a case for shifting the societal emphasis from economic growth to *wellbeing*.
- CPB (2020) presents the existing effects of the pandemic on the *Dutch economy*, which has fared better than other EU economies.
- DSGC (2020) outlines the synergy between *public and private investments*, putting government in the driving seat for future development.
- Deloitte (2020a) lists the main *challenges for infrastructure* development during and after the pandemic.
- Deloitte (2020b) argues that *green infrastructure investments* will create more jobs than other investments.
- Ernst & Young (2020) gives specific *infrastructure investment advice* for economic recovery
- IEA (2020) reports that *renewable energy systems* have been more resilient to demand shocks from the crisis.
- ING (2020) focuses on the economic crisis and the effect of *macroeconomic measures*.
- OECD (2020) gives specific ideas for *building back better* with special emphasis on fostering *resilience* to future shocks.
- PBL (2020) overviews the effect of the ongoing pandemic on *climate change* and shows scenario analysis projections.
- RLi (2020) argues that there is no tension between economic recovery and the *sustainability transition* and suggests specific measures to be applied in the *Netherlands*.
- SCP (2020) comments that *sociocultural changes in Dutch society* are likely to rebound after the crisis.
- SCP, PBL and CPB (2020) call for *alignment* of short-term policies with long-term sustainability goals and *customization* in policy making.
- SER (2020) stresses the importance for having *inclusivity* driven measures as vulnerable groups are disproportionately affected by the ongoing crisis.
- TNO (2020) advocates for the role of *innovation* for getting out of the economic crisis.
- WEF (2020) presents ideas for steering future economic activity through *new models of growth*, well-being metrics and progressive taxation.

Feedback analysis

The feedback loops of the models were analyzed in order to induce the main message of the positionpaper and summarize it in a sentence or two.

- Club of Rome (2020) -> The reinforcing spread of well-being accounting adoption in the private sector is a balancing force of obsession over profit and/or GDP growth.
- CPB (2020) -> Despite the temporary positive effect of government measures, the economic crisis cannot be successfully overcome without addressing income inequality and quality of life since they are tightly connected to resilience to this and future crises.
- DSGC (2020) -> Government action for SDGs will create momentum, amplifying through a multiplier effect on private action. Ultimately, the need for action will be balanced out because enough resilience will be built in the system.
- Deloitte (2020a) -> The decrease in infrastructure investment balances out the funding gap created by the economic crisis.
- Deloitte (2020b) -> Infrastructure investments are the main driver of job growth as they create new jobs and lower the effect of job loss through productivity advancements.
- Ernst & Young (2020) -> Other than investments, infrastructure expenses on operation and maintenance can be a much-needed economic boost during times of crisis.
- IEA (2020) -> Even though, renewable energy technologies result in job loss in the short-term, they are superior in the long-term since they create more jobs and boost economic resilience to future crises.
- ING (2020) -> The economy is balanced through government economic support measures.
- OECD (2020) -> Environmentally destructive investments are reinforced by immediate economic growth and segregation. Land use and GHG emissions increase the likelihood of future shocks, while biodiversity, digitalization and supply chain length increase resilience to future shocks.
- PBL (2020) -> The reason that renewables seem to be more resilient to the crisis might simply be because they are driven by the Paris agreement rather than profitability.
- RLi (2020) -> Sustainability projects are reinforced through immediate benefits like job creation and long-term benefits like the improvement of natural resource quality.
- SCP (2020) -> The economic crisis manifested through widening inequality is diminishing the government's ability to contain the health crisis.
- SCP, PBL & CPB (2020) -> GDP-centered policies might address the crisis in the short-term, but in the long-term they will create more damage since they debilitate the ability to solve the upcoming climate crisis.
- SER (2020) -> The state of the economy, which is highly interdependent on the state of healthcare and social policy for the vulnerable, is crippling.
- TNO (2020) -> Innovation is the only way to put the economy back on a growth path and fix public debt.
- WEF (2020) -> The acceleration of economic trends due to COVID-19 is undermining social mobility systems. There is hope in adopting new metrics for economic performance and new growth models based on innovation and human capital.

Debate issues

The table presents key issues of consensus and dissensus in the debate.

Issue	Agreement	Disagreement	Not discussed
Investing in sustainability will create a competitive advantage for Dutch companies	DSGC; RLi; TNO; CPB; Deloitte (b); IEA	N/A	Deloitte (a); ING; OECD; PBL; E&Y; SCP; SCP, PBL & CBP; CoR; SER; WEF
Protectionist policies have a positive effect on economic resilience	TNO; RLi; OECD, Deloitte (a); DSGC; CoR	ING; OECD, Deloitte; DSGC; CPB	SER; PBL; Deloitte (b); E&Y; IEA; SCP; SCP, PBL & CBP; SER, WEF
Investment in innovation is important for economic recovery	TNO; DSGC; OECD; RLi; SER; CoR; WEF; IEA	N/A	Deloitte(a); ING; PBL; CPB; Deloitte (b); E&Y; SCP; SCP, PBL & CBP; SER
Climate change policies are important for economic recovery	PBL; DSGC; OECD; RLi; SER; TNO; CoR; CPB; Deloitte (b); E&Y; IEA; SCP; SCP, PBL & CBP; WEF	N/A	Deloitte(a); ING
It is important to have inclusive accessible policies	SER; RLi; OECD; DSGC; CPB; CoR; IEA; SCP; SCP, PBL & CBP; WEF	N/A	TNO; PBL; ING; Deloitte (a); Deloitte (b); E&Y
There should be focus on building resilience to future shocks	OECD; TNO; SER; DSGC; CPB; CoR; Deloitte (b); E&Y; IEA; SCP, PBL & CBP; WEF	N/A	RLi; PBL; ING; Deloitte (a); SCP
Recovery should be focused on well-being metrics rather than GDP	CoR; OECD; SER; WEF	N/A	CPB; Deloitte (a); Deloitte (b); DSGC; E&Y; IEA; ING; PBL; RLi; SCP; SCP, PBL & CBP; TNO
Post-COVID-19 consumer behavior shift is uncertain	Deloitte (a); ING; OECD; PBL; RLi; IEA; SCP, PBL & CBP	ING; WEF	DSGC; SER; CoR; CPB; Deloitte (b); E&Y; SCP; TNO
Public debt is not an issue in the Netherlands	CPB; ING; SER	N/A	CoR; Deloitte (a); Deloitte (b); DSGC; E&Y; IEA; OECD; PBL; RLi; SCP; SCP, PBL & CBP; TNO; WEF
Government should take a more active role in steering investment	CoR; DSGC; Deloitte (b); E&Y; IEA; OECD; PBL; RLi; SCP, PBL & CBP; SER; WEF	N/A	CPB; Deloitte (a); ING; SCP; TNO
Anticipated post-COVID GDP development will be the same or worse than pre-COVID GDP	CPB; Deloitte (b); ING; PBL	E&Y, IEA; TNO	CoR; Deloitte (a); DSGC; OECD; RLi; SCP; SCP, PBL & CBP; SER; WEF
There is synergy between the health standard and the economy	SER; CoR; DSGC; IEA; OECD; RLi	N/A	CPB; Deloitte (a); Deloitte (b); E&Y; ING; PBL; SCP; SCP, PBL & CBP; TNO; WEF
Green recovery will create jobs, possibly more than non-green recovery	Deloitte (b); DSGC; E&Y; IEA; OECD; RLi?	N/A	CoR; CPB; Deloitte (a); ING; PBL; SCP; SCP, PBL & CBP; SER; TNO; WEF
Th crisis has a negative effect on productivity, which is difficult to overcome in the future	CPB; ING	TNO; Deloitte (b); E&Y IEA; OECD	CoR; Deloitte (a); DSGC; PBL; RLi; SCP; SCP, PBL & CBP; SER; WEF
Investments will decrease as a result of the crisis	WEF; CPB; Deloitte (a); IEA	N/A	PBL; SCP; E&Y; ING; OECD; RLi; SCP, PBL & CBP; CoR; SER; TNO; Deloitte (b); DSGC; E&Y
Investments will aid economic recovery	E&Y; IEA; ING; OECD; RLi; SCP, PBL & CBP; CoR; SER; TNO; Deloitte (b); DSGC; E&Y; WEF; CPB; Deloitte (a)	N/A	PBL; SCP
Investment in human capital is key to economic recovery	ING; OECD; RLi; SCP, PBL & CBP; CoR; SER; WEF	N/A	PBL; SCP; TNO

Club of Rome (2020)

Summary

Club of Rome (2020) presents a case for shifting the societal emphasis from economic growth to wellbeing. In order to do that European countries must actively start measuring wellbeing metrics and using them as focal points for policymaking as opposed to strictly relying on GDP growth. Pessimistically, the report reminds readers of how little has been done on the path to reaching sustainability and urges radical action as the only way to deal with inevitable future crises that arise from destructive ‘business as usual’ actions.

Implications for infrastructure

Much of the report addresses the emerging wellbeing economy with suggestions for new measures of human wellbeing and prosperity. Infrastructure companies are urged to adopt these measures and align decision-making to these measures. Another recommendation regards political consensus and collaboration as the shift can only be achieved collectively.

Stock-and-flow diagram

The model tells a simple story of how organizations reporting on wellbeing measures and aligning their decision-making processes on well-being measures is a reinforcing loop (much like an innovation adoption loop), which has the potential to balance out the traditional growth model of the economy whereby production leads to consumption, which reinforces production. Only by shifting emphasis on wellbeing rather than growth, can the cycle of production for production’s sake be balanced.

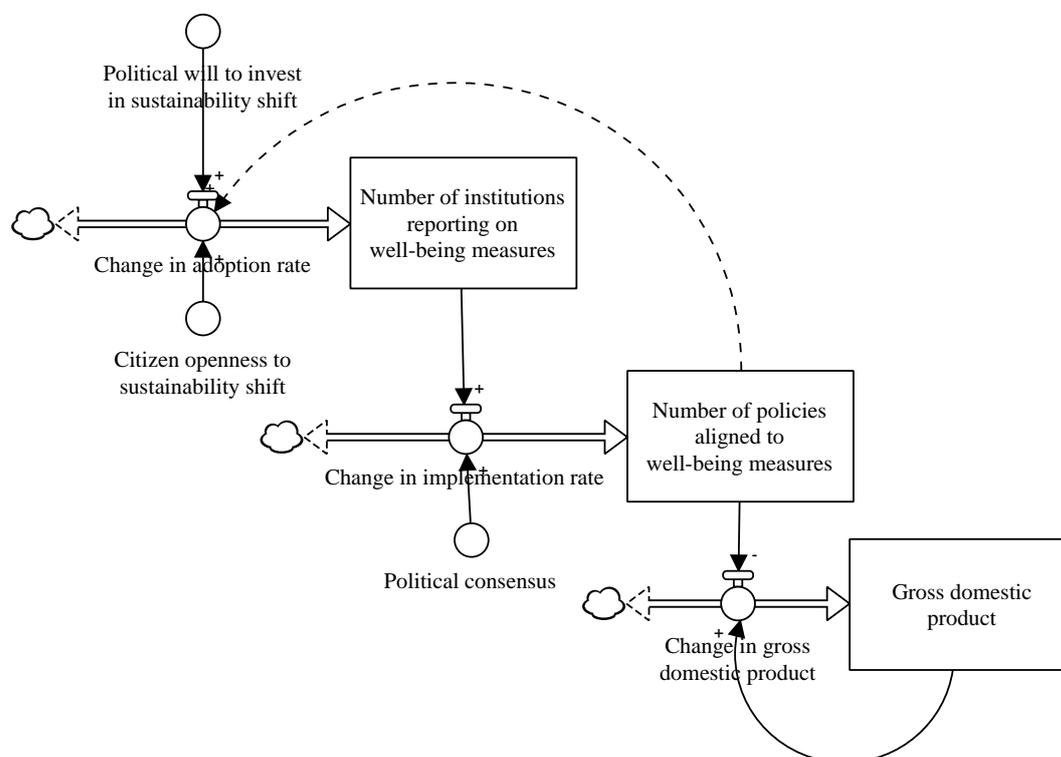


Figure 1. Stock-and-flow diagram based on Club of Rome (2020). The dotted arrow is an assumption induced from the document.

Variable name	Description	Quote	Page
Number of institutions reporting on well-being measures	The number of organizations that have adopted alternative accounting	Bundling new economic measures and indicators of wellbeing and social progress in a way that values wellbeing, health and nature rather than being fully dependent on growth as measured by GDP	5
Number of policies aligned to well-being measures	The number of organizations that base their decision-making on wellbeing rather than economic growth	Aligning the EU's policy framework with the pursuit of collective, sustainable and inclusive wellbeing rather than narrow GDP growth.	5
Gross domestic product	The size of economic production	A circular economy serving needs rather than driving consumption from production	4

Table 1. A description of the most important variables in the model.

Reference

Club of Rome (2020) *21st century wellbeing economics: The road to recovery, renewal & resilience*. <https://clubofrome.org/wp-content/uploads/2020/09/21ST-Century-WELLBEING-1.pdf>, accessed on 21 October 2020.

Central Planning Bureau (2020)

Summary

This report presents an overview of the state of the Dutch economy, highlighting the effects the pandemic has had on the economy so far as well as projecting economic development in the coming year. Two scenarios are presented: a baseline projection and a second-wave projection. The prediction in the former is economic growth in 2021, while the latter predicts further economic decline. It is shown that the pandemic and its mitigation measures have worsened income inequality. Detailed argumentation is given on the effects of wages, static purchasing power, pensions and inflation.

Implications for infrastructure

Given the current crisis, there is an overall reduction in investments. The economic recovery projections show that investments will recover more slowly than consumption. This is especially true for housing investments since it is found that the housing market has a delayed response in times of economic crisis. On the other hand, government expenditures which are largely composed of investments on infrastructure or on reaching the climate goals, were the only economic activity contributing to GDP growth in the past quarter.

Stock-and-flow diagram

Macroeconomic recovery from the COVID-19 economic crisis is said to have already started at the time of publishing this report, not taking into account the second wave and measures introduced in October 2020. The pace of economic recovery is dictated by the prevalence of the virus (see Figure 1), inherent economic resilience and government support measures that cushion the economic blow. The effectiveness of these measures is said to decrease over time as the crisis gets worse, hitting the housing sector and international finances.

Compared to other European countries, the Netherlands has fared quite well. This is attributed to the extent to which economic activity is already digitized, as this has made it easier to work from home during lockdown; the overall economic sectoral structure, which is not heavily dependent on tourism or luxury consumer goods; and the existing social security scheme, such as unemployment benefit payments which have cushioned the blow on consumer demand and average wage; thus increasing the pace of economic recovery (see Table 1).

On the other hand, this inherent economic resilience is threatened by the pandemic's adverse effects on socioeconomic inequality, which has only been unintentionally worsened by existing government policy since there is a lack of focus on the vulnerable (temporary contract workers, self-employed, flexi workers, participants in informal economy etc). Not only have these worsened employment and income inequality, but this effect is being enforced in the long term through education inequality as the vulnerable have worse conditions to engage in homeschooling and online education. The result of this is a vicious loop affecting quality of life for the vulnerable and their opportunities to advance socioeconomically. Moreover, quality of life increases the risk for



contracting COVID-19, increasing the overall prevalence of the coronavirus and further reinforcing inequality.

Government measures support the extent of labor hoarding, thus lowering productivity and gross domestic product growth. This only increases the need for future government measures which will further support labor hoarding. A similar argument is given for the difficulty in tackling unemployment since initial economic recovery is likely present itself as an increase in working hours of existing employees, only affecting unemployment in the long-term when companies are financially secure enough to invest in new employees. Along with a general lack of job seeking confidence during this crisis, the rise in unemployment, seen through a change in labor supply in the model, is one of the most obvious symptoms of this crisis.

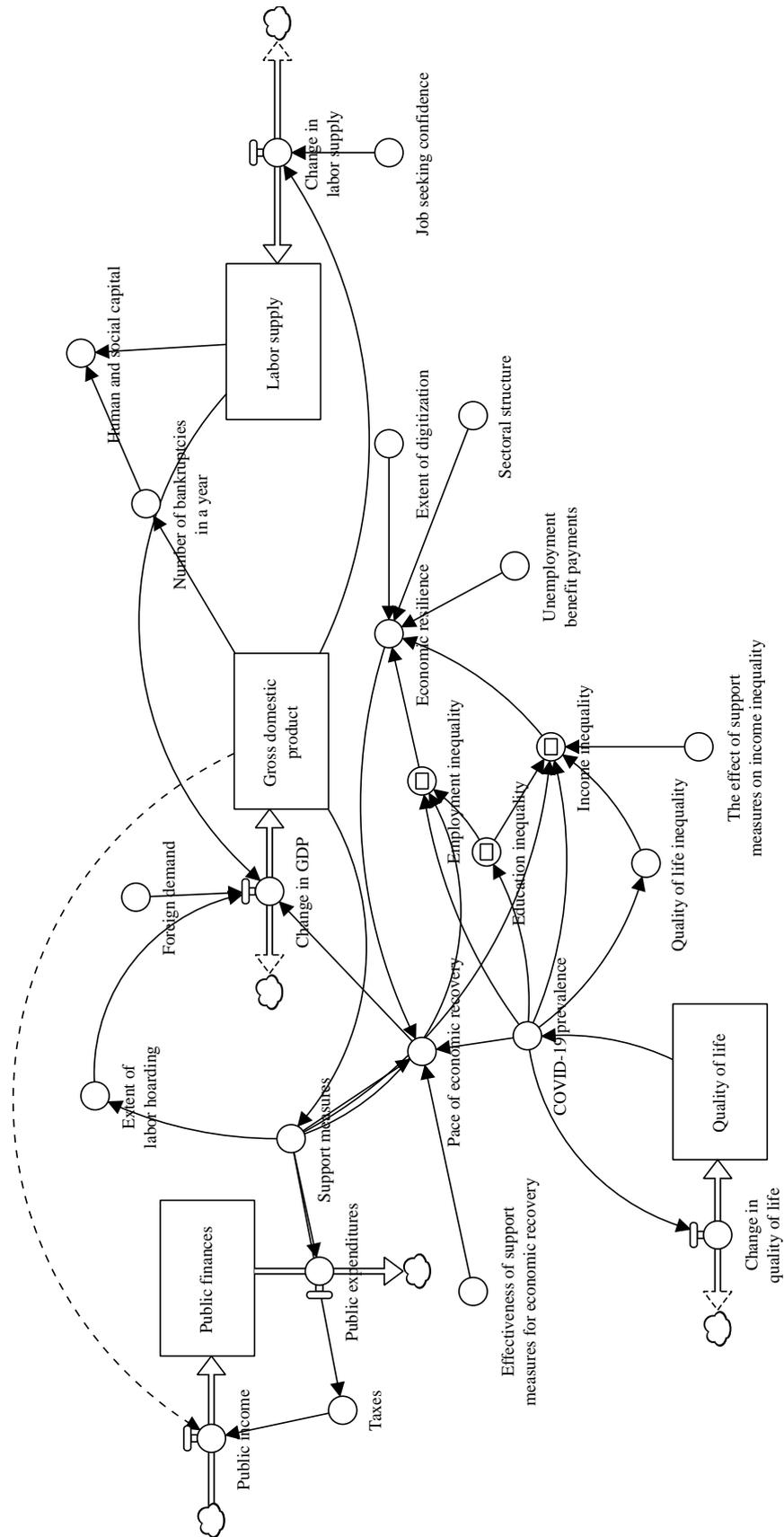


Figure 2. Stock-and-flow diagram based on Central Planning Bureau (2020)

N.	Page	Quote	Causal link
1	1	Public finances have been severely impacted by support measures and lower tax revenues, but they are not in jeopardy.	Taxes -> Public income -> Public finances -> COVID-19 prevalence GDP -> Public income Support measures -> Public expenditures
2	2	Discouraged by the crisis, fewer people are actively in search of employment.	Job seeking confidence -> Change in labor supply
3	3	The challenge is to address underlying inequality, so that society will be more resilient if and when the next crisis hits	Employment inequality -> Economic resilience Income inequality -> Economic resilience
4	4	Economic activity has partly rebounded, following the lifting of a large number of physical contact restrictions.	COVID-19 prevalence -> Pace of economic recovery
5	4	Unemployment and bankruptcies are slowly responding to GDP development.	GDP -> Change in labor supply GDP -> Number of bankruptcies
6	4	As the crisis lasts longer, hopes of a full recovery are fading away.	COVID-19 prevalence -> Pace of economic recovery
7	4	Bankruptcies and unemployment are damaging intangible assets and human capital	Number of bankruptcies -> Human and social capital Labor supply -> Human and social capital
8	4	The extent to which countries are able to combat the virus and whether new or prolonged physical contact restrictions prove necessary in the coming period will determine the pace of economic recovery.	COVID-19 prevalence -> Pace of economic recovery Effectiveness of support measures -> Pace of economic recovery Support measures -> Pace of economic recovery
9	4	Things like neighbourly support, family visits and home schooling cannot all be captured in economic growth figures. The corona crisis has major consequences for the things that affect quality of life, such as celebrating a wedding or jubilee, and going to festivals, theatres and concerts	COVID-19 prevalence -> Change in quality of life -> Quality of life
10	4	Young people, the self-employed, flex workers and vulnerable groups on the labour market carry a disproportionately large share of the economic effects of the crisis.	COVID-19 prevalence -> Employment inequality Support measures -> Income inequality
11	4	Corona can also increase existing unequal opportunities in education and thus exacerbate income inequality, in the long term.	COVID-19 prevalence -> Education inequality -> Income inequality
12	4	The real challenge lies in tackling the underlying vulnerabilities themselves to ensure that society is more resilient by the time the next crisis hits.	Employment inequality -> Economic resilience Income inequality -> Economic resilience
13	7	The extent to which countries have automatic stabilisers or can afford generous financial support policies, partly determines the severity of the downturn and probably also the pace of recovery.	Unemployment benefit payments -> Economic resilience -> Pace of economic recovery
14	7	The initial shock is now primarily affecting domestic demand, rather than external demand.	Foreign demand -> Change in GDP -> Gross domestic product
15	7	Nevertheless, in most other countries, the blow is even greater. It is too early for a definitive analysis of what causes this difference, but explanatory factors are likely to include the not too strict lockdown, the Dutch sectoral structure (i.e. not heavily dependent on tourism or consumer durables such as cars), the size and rapid implementation of the policy support package, and the relatively advanced nation-wide digitisation that has facilitated working from home and online retail.	Sectoral structure -> Economic resilience Extent of digitization -> Economic resilience
16	9	But the support policy cannot prevent bankruptcies and lay-offs when companies have to adapt to a changing demand. This means that the effectiveness of the support policy will gradually decrease.	Effectiveness of support measures on economic recovery -> Pace of economic recovery Support measures -> Pace of economic recovery

17	9	Breaking down GDP development by spending category in the baseline projections shows that, this year, the government is the only party contributing positively.	Support measures -> Pace of economic recovery -> Change in GDP -> Gross domestic product
18	10	With the NOW (Temporary Emergency Bridging Measure to Preserve Employment), the government has facilitated labour hoarding, but the effectiveness of this policy is gradually diminishing.	Support measures -> Extent of labor hoarding -> Change in GDP
19	10	Extension of the support policy reduces the increase in unemployment.	Support measures -> Pace of economic recovery -> Change in GDP -> Gross domestic product -> Change in labor supply -> Labor supply
20	14	The government is trying to cushion the impact by automatically expanding the budget in cases of economic setback. This automatic stabilisation mechanism has worked very well; the lower tax revenues and additional spending on unemployment benefit payments (WW) will negatively impact the balance by as much as 27.7 billion euros in 2020	Unemployment benefit payments -> Economic resilience
21	14	Research into countries that were relatively hard hit by, for example, SARS and MERS, shows that income inequality increased at the time. The existing institutional and economic structure is also important for the level of impact on inequality. Policy responses also play an essential role.	COVID-19 prevalence -> Education inequality COVID-19 prevalence -> Employment inequality COVID-19 prevalence -> Income inequality Support measures -> Income inequality
22	16	This effect is exacerbated even further if people with a lower socio-economics status are also more at risk of being exposed to the virus; for example, because they are more likely to have jobs in which working from home is not possible, are dependent on public transport, work in poorer working conditions, or live more often in densely populated neighbourhoods.	Quality of life -> COVID-19 prevalence
23	17	Although support policy is both necessary and generous, the unintentional side effect is an increase in inequality on the labour market.	Support measures -> Income inequality Support measures -> Employment inequality
24	18	In the long term, too, the corona crisis may increase inequality by exacerbating the already existing unequal opportunities in education. Home schooling is a lot more difficult for those living in small homes, those who have less access to digital or other educational resources and for parents who have a lower education level themselves	COVID-19 prevalence -> Education inequality

Table 1. Causal links found within Central Planning Bureau (2020)

Reference

Central Planning Bureau (2020) *Macro Economic Outlook (MEV) 2021*. <https://www.cpb.nl/macroeconomische-verkenning-mev-2021>, accessed on 19 October 2020.



Deloitte (2020b)

Summary

Deloitte (2020) presents the challenges that face infrastructure companies as a result of COVID-19. Specifically, the pandemic has caused many development contracts to be dropped or slowed, leaving infrastructure companies in a liquidity crisis and creating funding gaps. Other than this, a major challenge is the unexpected drop in demand for and usage of certain types of infrastructure assets, such as transportation. The report projects an overall decrease in infrastructure investment in the short to medium term and a portfolio diversification trend.

Implications for infrastructure

This report presents the ongoing pandemic as “an opportunity for infrastructure investors to acquire valuable hard assets from a valuation perspective (which is typical during an economic downturn) and reposition for the longer term when various initiatives have stabilized and there is an economic rebound” (p. 2). In addition to this, a list of key considerations for infrastructure companies is presented.

Stock-and-flow diagram

Infrastructure assets are modeled according to three phases: development, construction and operations. Each asset is found in one of these phases. Assets under construction or in operation are said to have suffered the largest impact due to COVID-19 as many contractors have declared force majeure or the demand for usage of certain assets (e.g. airplanes) has decreased due to virus containment measures.

Companies receive income from operation activities, so, naturally, these two challenges have adversely impacted company income, lowering the financial resources of the companies and posing a challenge for expenditures. This unexpected decrease of income has challenged liquidity and thus future investments, widening the infrastructure gap even further (the gap between Money needed to be invested in infrastructure and Money invested in infrastructure).

This cycle might improve the financial situation in the short term, but ultimately comes back to debilitate future earnings as investments drive the potential for future income through new infrastructure development. This problem echoes in construction as well as development as companies are faced with a funding gap resulting from low liquidity which prevents them from finishing certain construction activities.

The main stocks in the model are described in Table 1, while the causal links are the subject of Table 2.

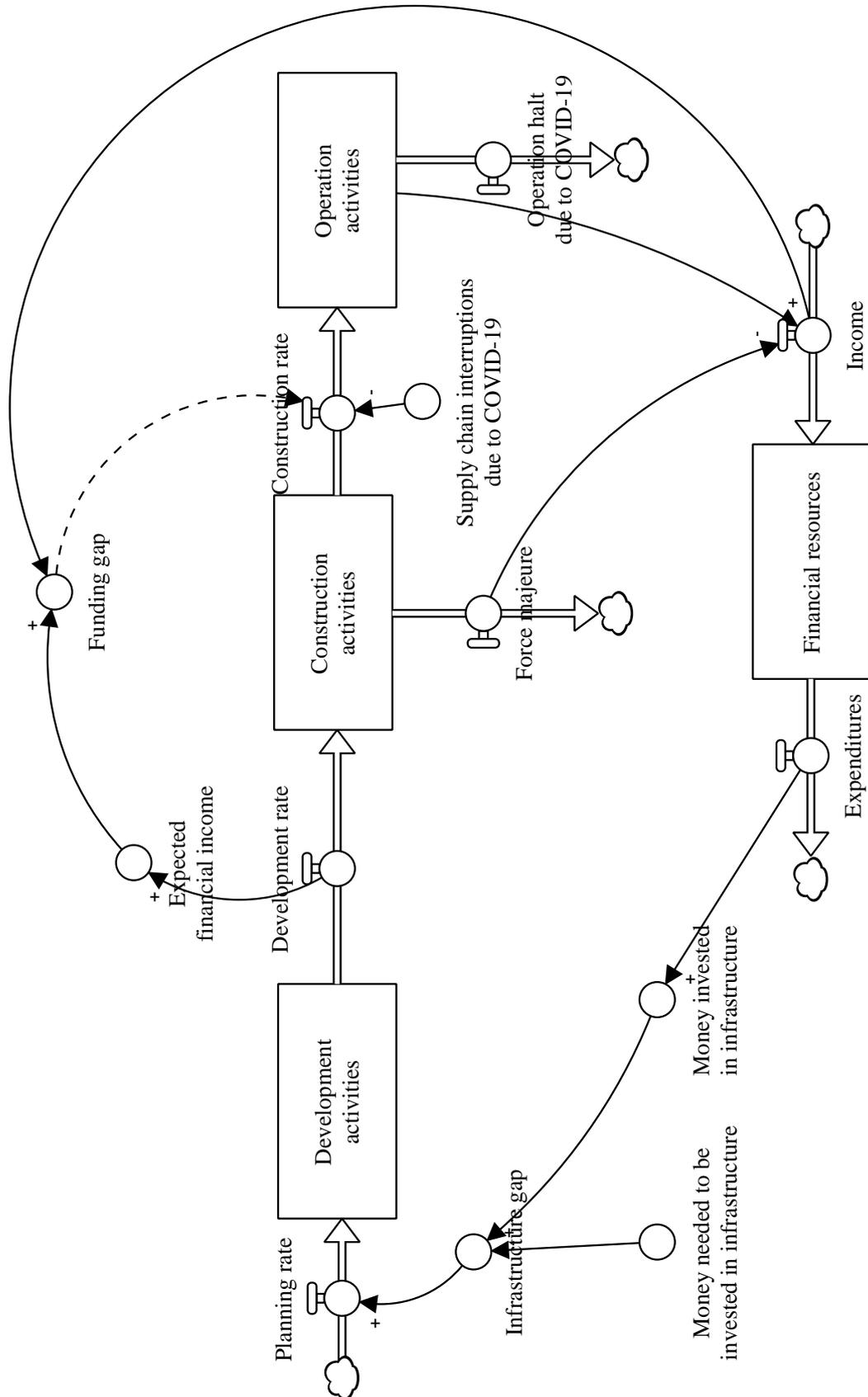


Figure 3. Stock-and-flow diagram based on Deloitte (2020). The dotted arrow is an assumption induced from the document.

Variable name	Description	Quote	Page
Assets under development	The number of ongoing infrastructure development projects	The impact on infrastructure companies can be assessed during any of the following phases: development, construction and operations	2
Assets under construction	The number of ongoing infrastructure construction projects	The impact on infrastructure companies can be assessed during any of the following phases: development, construction and operations	2
Assets in operation	The number of operating infrastructure assets	The impact on infrastructure companies can be assessed during any of the following phases: development, construction and operations	2

Table 2. A description of the most important variables in the model.

N.	Page	Quote	Causal link
1	2	This is creating liquidity challenges resulting in funding gaps.	Development rate -> Expected financial income -> Funding gap Income -> Funding gap
2	2	The Government might prioritize its spending commitment in light of the pandemic, with a revised budget for 2020 focused more on recurrent expenditure, this could impact the annual gap in infrastructure investment in the short to medium term, except with interventions.	Expenditures -> Money invested in new infrastructure development -> Infrastructure gap Money needed to be invested in new infrastructure development -> Infrastructure gap
3		The infrastructure sector utilises people and equipment (largely fixed costs), thus companies and contractors with high levels of debt and low cash reserves may face a liquidity crisis.	Income -> Financial resources -> Expenditures
4	2	Supply chain interruptions will likely continue, affecting the availability of parts and equipment, and eventually impact projects.	Supply chain interruption -> Construction rate
5	2	The impact on infrastructure companies can be assessed during any of the following phases: development, construction and operations	Planning rate -> Assets under development -> Development rate -> Assets under construction -> Construction rate -> Assets in operation
6	2	There has been a downward spiral in demand and usage of major infrastructure assets like transportation due to the lockdown.	Share of operations halted due to COVID-19 -> Operation halt rate

Table 3. Causal links found within Deloitte (2020)

Reference

Deloitte (2020a) *The impact of COVID-19 on infrastructure projects and assets.*
<https://www2.deloitte.com/ng/en/pages/finance/articles/the-impact-of-COVID-19-on-infrastructure-projects-and-assets.html#>, accessed on 12 October 2020.

Summary

Speeding up infrastructure investments will speed up economic recovery by creating jobs. Similar to Ernst & Young (2020), Deloitte (2020b) recommends a mix of small maintenance projects that are usually in backlog and mega projects focused on sustainability. Further, technology should be seized wherever possible, enabling digital infrastructure delivery. Finally, according to multiple sources, sustainable investments create a significant advantage compared to business as usual investments, which indicates that green recovery would make post-COVID-19 Netherlands better than pre-COVID-19 Netherlands.

Implications for infrastructure

Infrastructure companies have a key role to play in addressing inequalities. Mega projects can boost regional growth through job creation, economically empowering the vulnerable who have suffered the direst consequences from the pandemic. Similar to Ernst & Young (2020), given the Netherlands' nitrogen problem, special emphasis can be put on digital infrastructure as opposed to physical infrastructure.

Stock-and-flow diagram

Infrastructure projects are a great instrument for economic recovery. Despite the economic downturn, the rate of investment must not halt as it can lead to delayed consequences in the future. Quite contrary, investments hold the key to creating jobs and preventing future job loss, thus addressing the COVID-19 economic crisis (see Figure 1).

Increases in infrastructure assets will boost economic productivity and can have a positive effect on social mobility. In fact, infrastructure is a powerful enabler that can give the non-privileged an opportunity to catch up with those less adversely affected by the crisis. Not only does it have a key role in addressing growing inequalities, infrastructure is a key player in the sustainability transition as multiple findings indicate that sustainability driven investments will create significantly more jobs in the long run, strengthening the Dutch economy.

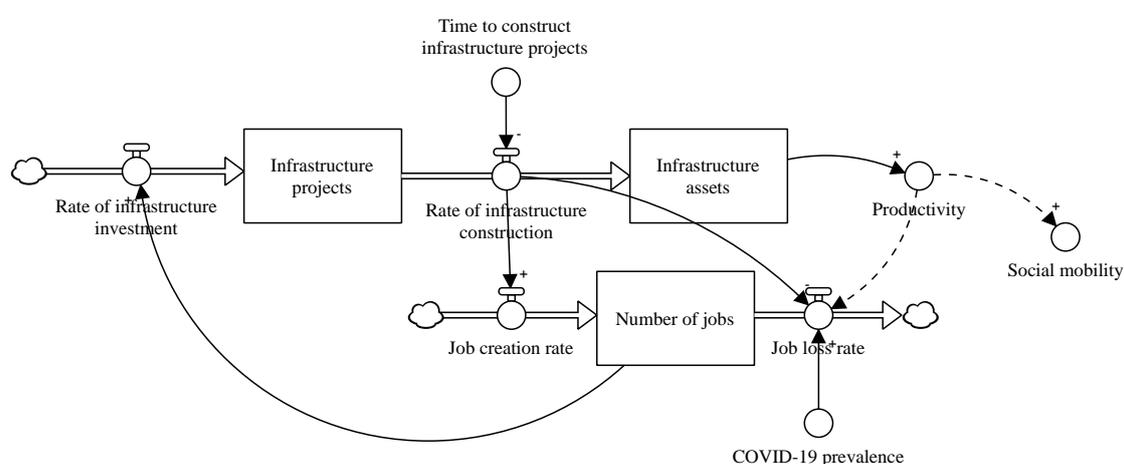


Figure 4. Stock-and-flow diagram based on Deloitte (2020b). The dotted arrow is an assumption induced from the document.

N.	Page	Quote	Causal link
1	3	Unless explicitly stimulated through public policy of the central government, the economic downturn will cause less initiation of infrastructure, capital and construction projects, and projects in the pipeline are being postponed.	Number of jobs -> Rate of infrastructure investment -> Infrastructure projects -> Rate of infrastructure project construction
2	3	When current construction plans will be postponed or canceled, severe effects will be felt in the future.	Time to construct infrastructure projects -> Rate of infrastructure project construction
3	5	Limited proactivity could lead to a prolonged financial downturn with large job losses as a direct result.	Rate of infrastructure project construction -> Job creation rate
4	5	The megaprojects should all continue at the fastest pace possible in the current climate as it provides the base load for the sector and can shield the economy from further job loss.	Rate of infrastructure project construction -> Job loss rate
5	5	Infrastructure improves the productivity of the nation allowing goods and resources to move throughout the economy.	Infrastructure assets -> Productivity

Table 1. Causal links found within Deloitte (2020b)

Reference

Deloitte (2020b) *Infrastructure investments as economic stimulus in a post COVID-19 world.*

<https://www2.deloitte.com/content/dam/Deloitte/nl/Documents/real-estate/deloitte-nl-infrastructure-investments-as-economic-stimulus.pdf>, accessed on 26 October 2020.

Dutch Sustainable Growth Coalition (2020)

Summary

The main argument from DSGC (2020) is that clear government action for the Sustainable Development Goals (SDGs) will bring about a multiplier effect as private companies will get confidence to contribute private action for SDGs (see Figure 1). The actions for SDGs, or the lack thereof, are expected affect a set of outcomes: Health standards, Number of jobs, Competitive advantage of Dutch companies, Supply chain inclusivity and Speed of sustainable transition. Based upon the text (DSGC, 4:2020), the author assumes that these outcomes will reinforce the economy, feeding back to public and private capability for SDGs action. Last, it is assumed that the Health standard and Economic resilience have an effect on the size of required COVID-19 recovery instruments, ultimately halting the need for SDG action.

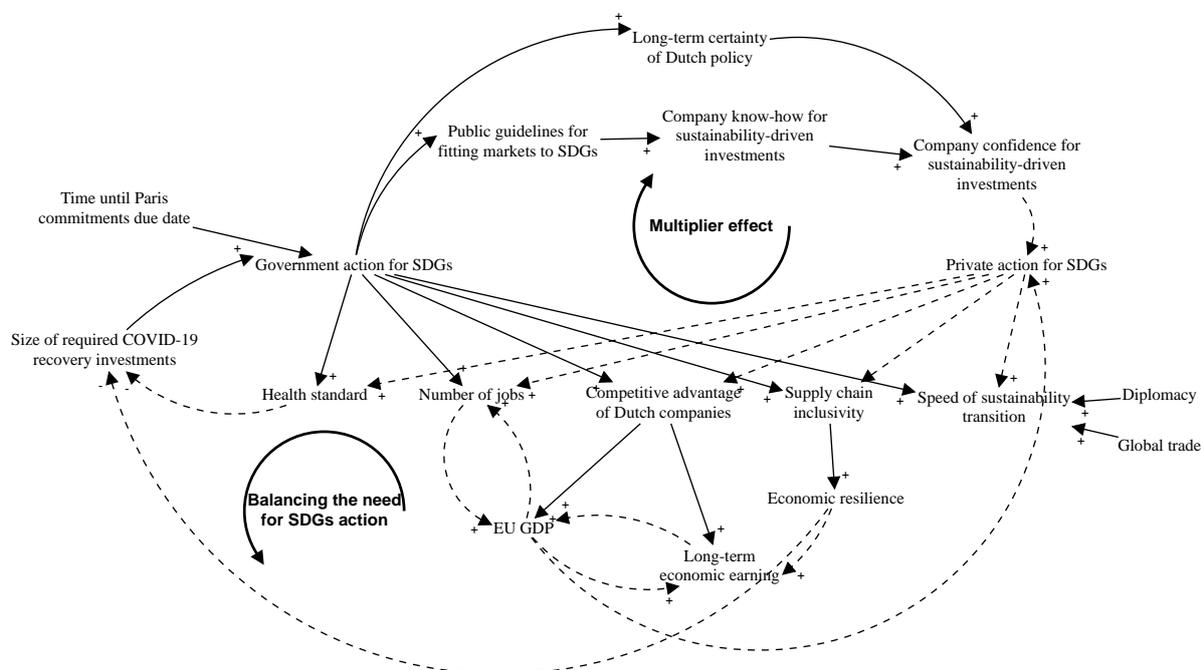


Figure 5. Causal loop diagram depicting the argumentation from DSGC (2020)

What is understood as (government or private) action for SDGs?

According to DSGC (5:2020), which claims “We would strongly encourage using the EU Recovery Funds for substantial investments in the fields of energy transition infrastructure, circular economy models, capability development, cleaner mobility solutions (including cleaner fuels), nature-based solutions, ecosystem restoration and schemes to drive low-carbon product demand.”, action for SDGs is understood as investments in circular economy business models, nature based solutions, capability development, ecosystem restoration, cleaner mobility solutions, schemes to drive low-carbon product demand and energy transition infrastructure.

N.	Source	Quote	Causal link	Polarity
1	(DSGC, 4:2020)	A focus on social responsibility and climate action through the lens of the UN Sustainable Development Goals (SDGs) will reinforce economies	Government action for SDGs -> Economic resilience	Positive
2	(DSGC, 4:2020)	Building supply chains with inclusiveness and sustainability embedded will help to create stable and more resilient economies on both sides.	Supply chain inclusivity -> Economic resilience (contained within 1)	Positive
3	(DSGC, 4:2020)	Given the size of the required recovery investments and the shortening time until our Paris commitments, we should take full advantage of this opportunity.	Time until Paris commitments -> Government action for SDGs	Negative
4	(DSGC, 4:2020)	Given the size of the required recovery investments and the shortening time until our Paris commitments, we should take full advantage of this opportunity.	Size of required COVID-19 recovery investments -> Government action for SDGs	Positive
5	(DSGC, 4:2020)	The EU Green Deal combined with a strong strategy for investments, global trade and diplomacy has the potential to accelerate sustainability transitions in global value chains.	Global trade -> Speed of sustainability transition	Positive
6	(DSGC, 4:2020)	The EU Green Deal combined with a strong strategy for investments, global trade and diplomacy has the potential to accelerate sustainability transitions in global value chains.	Diplomacy -> Speed of sustainability transition	Positive
7	(DSGC, 4:2020)	The EU Green Deal combined with a strong strategy for investments, global trade and diplomacy has the potential to accelerate sustainability transitions in global value chains.	Government action for SDGs -> Speed of sustainability transition	Positive
8	(DSGC, 4:2020)	Subsequently, this will increase EU GDP, improve health standards and create millions of decent jobs.	Government action for SDGs -> EU GDP (contained within 10 and 11)	Positive
9	(DSGC, 4:2020)	Subsequently, this will increase EU GDP, improve health standards and create millions of decent jobs.	Government action for SDGs -> Health standards	Positive
10	(DSGC, 4:2020)	Subsequently, this will increase EU GDP, improve health standards and create millions of decent jobs.	Government action for SDGs -> Number of jobs	Positive
11	(DSGC, 5:2020)	By investing in selected sustainability competencies, innovations, and knowledge, we can build competitive advantages.	Government action for SDGs -> competitive advantage of Dutch companies	Positive
12	(DSGC, 5:2020)	Investments in sustainable solutions in the medium-term are necessary for our economy's long-term earnings model	Government action for SDGs -> Long-term economic earning (contained within 1, 10 and 11)	Positive
20	(DSGC, 5:2020)	Investments following from the EU Green Deal ...have the potential to bring about a multiplier effect in mobilizing the required public and private capital	Government action for SDGs -> Private action for SDGs	Positive
21	(DSGC, 5:2020)	When done right, these clear objectives and roadmaps provide companies with the confidence to invest in green, net-zero emission solutions for our future needs.	Government action for SDGs -> Company confidence for sustainability-driven investments (contained within 20)	Positive
22	(DSGC, 5:2020)	We would welcome an independent Dutch study on how we can "Make markets fit for SDG purpose".	Public guidelines for fitting markets to SDGs -> Company know-how for sustainability driven investments (contained within 20)	Positive

Table 4. Causal links found within DSGC (2020)



Reference

Dutch Sustainable Growth Coalition (2020) *Dutch businesses endorse sustainability in COVID-19 recovery*. <https://www.dsgc.nl>, accessed on 5 October 2020.

Ernst & Young (2020)

Summary

Infrastructure investments are one of the key policy levers for economic recovery. Ernst & Young (2020) recommend a mix of small (maintenance) projects, which are often backlogged in order to stimulate local economies, positively impacting inequality and long-term capital projects, which have the potential to unleash new sources of economic growth and re-structure the economy for good of everyone, benefiting environmental recovery.

Implications for infrastructure

Apart from solid investment advice, the report emphasizes the importance of "InfraTech" as digital infrastructure will become even more important than physical infrastructure in post-COVID-19 society.

Stock-and-flow diagram

The very aggregate co-flow structure of this diagram represents the main argument that financial resources (including liquidity) go hand in hand with infrastructure development. So that, small projects can create quick finances and liquidity in the economy, while long-term projects set the stage for long-term income sustainability despite having a short-term negative effect on liquidity.

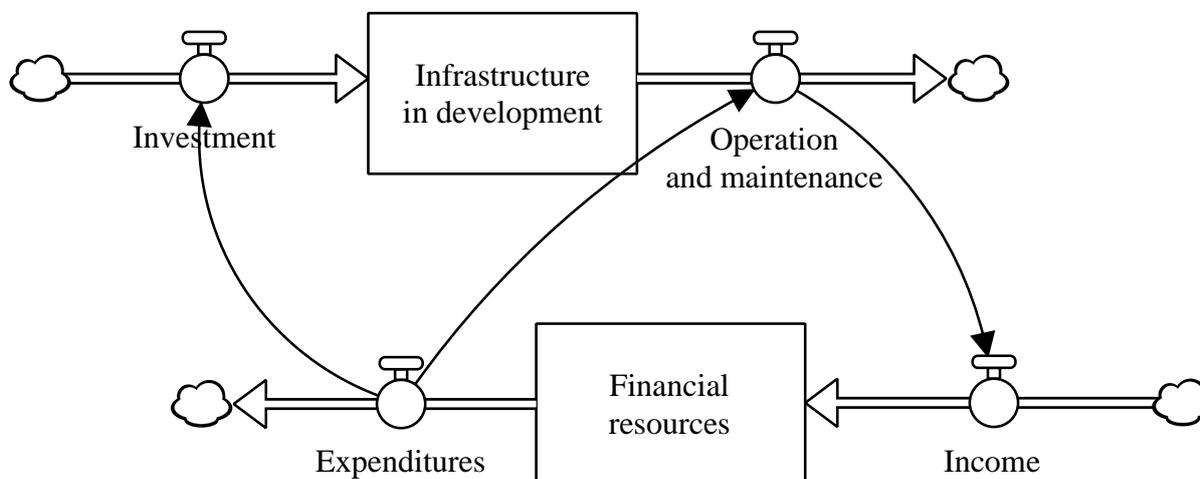


Figure 6. Stock-and-flow diagram based on Ernst & Young (2020). The dotted arrow is an assumption induced from the document.

Reference

Ernst & Young (2020) *Repairing the damage from COVID-19: How infrastructure spending can help economies return to full strength*. https://www.ey.com/en_ie/covid-19/how-infrastructure-spending-help-economies-return-strength accessed on 26 October 2020.



International Energy Agency (2020)

Summary

The International Energy Agency has created a detailed report in collaboration with the International Monetary Fund on suggestions for what governments can do to mitigate this and future crises. The report is focused on economic growth, job creation and resilience and sustainability of energy systems.

Implications for infrastructure

The report gives specific recommendations for measures in six key sectors, which may be of interest to infrastructure companies: electricity, transport, industry, buildings, fuels and emerging low-carbon technologies.

Stock-and-flow diagram

Both a 'quick recovery' and a 'green recovery' will be beneficial to jobs (see Figure 1). While a 'quick recovery' may focus on preventing job loss, a green recovery is focused on job creating in the short term, which comes at an initial cost of job loss but is followed with balancing out job loss in the long term through increases resilience in the energy sector.

The sustainability transition is tightly dependent on infrastructure investments as they are the main factor for energy use, affecting renewable energy adoption. The government, as well as private actors, have a key role to play in the transition. IEA (2020) reports that the biggest impact for 2021-2023 investments will be in energy efficiency, which would create jobs and positive affect climate goals.

The key message from the report is that, despite temporary reductions in energy demand, renewable energy sources have fared better during this crisis. Hence, the main focus should be on improving the resilience of energy systems because of the inevitable incoming climate change shocks and instabilities. For the moment investing in the sustainability transition is the best known way to improve resilience and it is the subject of a call to action in the report.

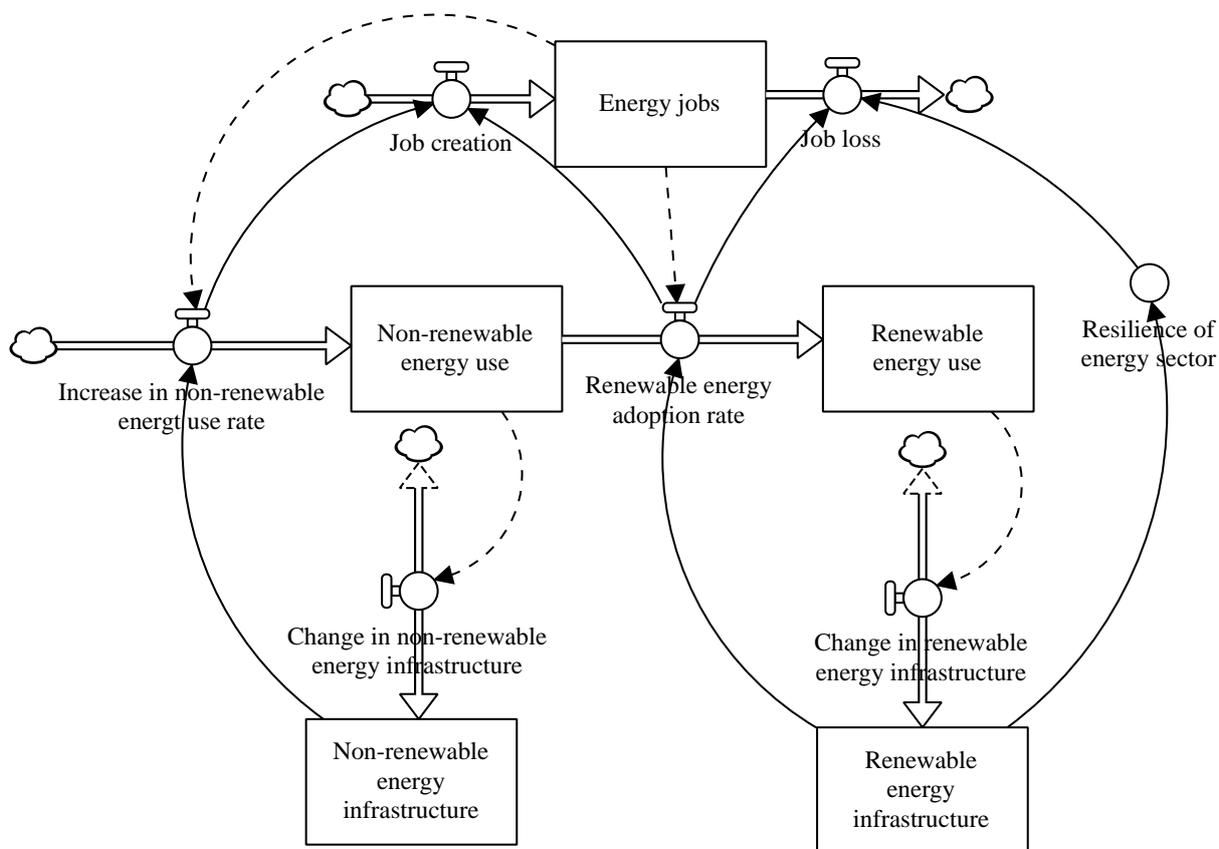


Figure 7. Stock-and-flow diagram based on International Energy Agency (2020). The dotted arrow is an assumption induced from the document.

Reference

International Energy Agency (2020) *Sustainable recovery*.

<https://www.iea.org/reports/sustainable-recovery> accessed on 26th of October 2020.



ING Economisch Bureau (2020)

Summary

This report explains the COVID-19 economic crisis as a crisis of low expenditures since consumers have not been able to spend as much as they usually do due to lockdown measures. In order to address this, ING Economisch Bureau (2020) describes three types of measures: tax relief, furlough packages, government investments and re-training policies. Each of these measures influences the economy at a different leverage point. The crisis is described as unprecedented, yielding much uncertainty about future developments or the long-term effects it will have on economic growth and consumer demands. What is certain, however, is that at the moment unemployment is going up, while business profitability and individual prosperity is going down. Much of the discussion is anchored on the rising government debt resulting from the above-mentioned economic measures as well as the generational conflicts that may come about because of that debt.

Implications for infrastructure

Infrastructure companies would be interested to read the predictions for the macroeconomy including GDP, productivity and labor projections, which vary among economists (see Figure on page 6). While the majority of economists agree that post-COVID-19 economic growth will be the same as pre-COVID-19 or lower, some say that it is likely that post-COVID-19 economic growth will significantly exceed pre-COVID-19 growth because of structural changes to economy (e.g. digitalization), which will enable it to emerge even stronger.

Stock-and-flow diagram

The COVID-19 induced economic crisis, much like economic growth, is dictated through a reinforcing loop between business profitability and individual prosperity. So that, profitability drives individual income, which then affects individual expenditures ultimately affecting business profitability. In addition, profitability affects changes in unemployment as lower productivity results in layoffs. In turn, unemployment is self-reinforcing as people lose their skills and access to networks. Unemployment is further reinforced through its effect on income.

Business profitability dictates GDP growth thereby impacting debt development. As an example, the debt ratio will decrease if post-COVID-19 economic growth is higher than pre-COVID-19 growth. The debt ratio influences the interest rate driving further change in profitability. Similarly, the interest rate influences the debt ratio, which then changes profitability. While protectionism is rising in popularity through talk of new tariffs, economists argue that this is counterproductive as it reduces economic efficiency and reduces the GDP.

The government support packages directly contribute to the debt ratio, reduce productivity and assumedly increase individual expenditures. As long as there are measures the uncertainty regarding post-COVID-19 demand shifts is reduced since even the unproductive companies benefit. This can be counterproductive since demand shifts may drive innovation and digitization, ultimately boosting productivity.

All in all, the pandemic has impacted private expenditures, causing an all-out economic crisis. Many businesses have been forced to digitalize, which may come to boost post-COVID-19 economic growth. Economists claim that the duration of the economic has an adverse effect on GDP potential growth, i.e. on economic recovery to pre-COVID-19 levels, as well as on unemployment developments. The government is therefore creating economic policy in light of uncertainty of economic development, which some criticize may debilitate business potential to pivot, innovate and adapt to shifts in demand, which may or may not continue post-COVID-19. See Table 1 for the most important variables in the model and Table 2 for a reference to the causal links in the model.

Variable name	Description	Quote	Page
Unemployment	Unemployment rate in the Netherlands	The corona crisis means an abrupt and deep downturn in the economy. This is painful in the short term but can also have major consequences in the long term in unemployment, bankruptcies and productivity.	1
Productivity	Average productivity rate in Dutch private sector	The corona crisis means an abrupt and deep downturn in the economy. This is painful in the short term but can also have major consequences in the long term in unemployment, bankruptcies and productivity.	1
Average business profitability	The average profitability of Dutch companies	The other half of the economists want to prevent labor and big capital from remaining in companies that are structurally not viable.	6
Average prosperity	The average savings/net worth of a Dutch citizen	Fear and loss of income hold back demand	3

Table 5. A description of the most important variables in the model.

N.	Page	Quote	Causal link
1	1	We still heard a lot of people who fear that all that extra spending will have to come back in the long run. The fear of it can influence the confidence in the future among Dutch consumers and businesses.	Effect of fear about future financial income on expenditures -> Average expenditures
2	1	People become long-term unemployed and therefore lose skills and network.	Unemployment -> Skills -> Change in unemployment Unemployment -> Access to networks -> Change in unemployment
3	3	The other half of the economists want to prevent labor and big capital from remaining in companies that are structurally not viable. This will stifle the long-term growth potential of the economy.	Change in profitability -> Average business profitability -> Potential for GDP growth -> GDP growth
4	2	Most economists expect that with a certain amount of debt the interest rate will rise,	Debt ratio -> Interest rate
5	2	We have never experienced a recession like this before, and we are completely in the dark as to how it will continue as we do not know how the epidemic will develop.	Uncertainty regarding pandemic development -> Duration of support packages
6	3	The usual flywheel that the income of one person through his spending leads to income for the other is slowed down by this.	Average expenditures -> Change in profitability -> Average profitability -> Average income -> Average prosperity -> Average expenditures
7	3	This crisis adds to the fact that some consumers delay or adjust spending for fear of being contaminated on the street or in shops	Pandemic duration -> Average expenditures
8	3	Because of fear of a deterioration of their own financial future, households are saving more as a precaution and their expenditure is therefore falling.	Effect of fear about future financial income on expenditures -> Average expenditures
9	3	Expenditure will fall even further if the recession actually leads to loss of income due to rising unemployment and weaker wages	Unemployment -> Average income -> Average prosperity -> Average expenditures

10	4	The duration of this economic dip will mainly depend on how long the virus will stay around and when an effective vaccine and / or whether treatment has been found.	Pandemic duration -> Average expenditures Pandemic duration -> Change in unemployment
11	4	Business tasks in which structural developments have accelerated or that have new product demand due to consumer habituation during the corona crisis (such as more online product demand of the elderly) are causing shifts, but this does not mean that the economy will be fundamentally different after corona than before the corona virus.	Uncertainty regarding post-COVID demand shifts -> Digitization
12	5	The longer the pandemic and contact restrictions prevent the economy from continuing to its old growth rate, the greater the chance that the economy will suffer permanent damage.	Pandemic duration -> Potential for GDP growth
13	5	Companies can reduce their vulnerability by building up additional stocks or by aligning suppliers in multiple countries, so as not to depend on a single country such as China.	Diversification of product chains -> Economic efficiency
14	6	Corona reinforces protectionist tendencies and leads to calls for the reduction of international production chains. This leads to less efficiency and therefore lower growth.	Diversification of product chains -> Economic efficiency -> GDP growth
15	6	Cost-benefit considerations in companies counterbalance anti-globalization trends, but it cannot be ruled out that the EU will follow this trend and, for example, will increase import tariffs.	Tariffs -> Diversification of product chains
16	6	The increase in digital working is yielding time and therefore productivity gains that many companies want to retain.	Pandemic duration -> Digitization -> Productivity
17	6	Re-training also limits the negative productivity consequences	Re-training -> Productivity
18	8	Another part of the economists argues that the exceptionally high uncertainty during this recession is the reason for the support to continue.	Uncertainty regarding pandemic development -> Duration of support packages
19	9	Government debt can become too high if interest rates rise. Economists agree that an exact ceiling is not known, but that there is a limit to debt.	Interest rate -> Debt ration
20	9	As long as the interest rate is lower than the (nominal) growth rate of the economy, the debt ratio will continue to decline as a result of growth.	GDP growth -> Debt ratio
21	14	If the virus is under control and the economy has recovered, reducing aid can prevent the government from keeping unhealthy companies alive longer. If that happens six months later, there will still be productivity gains, only slightly later. Only then will it be clearer which sectors change permanently.	Duration of support packages -> Uncertainty regarding post-COVID demand shift

Table 6. Causal links found within ING Economisch Bureau (2020)

Reference

ING Economisch Bureau (2020) *Het zekere voor het onzekere: Overheidsschuld staat verdere steun aan economie toe.* <https://www.eur.nl/en/media/2020-09-ingebzhet-zekere-voor-het-onzekeretcm162-201778>, accessed on 9 October 2020.

OECD (2020)

Summary

Building back better should repair humankind's relationship with nature, ensuring our future on the planet. In addition, it is important to do this inclusively, taking care of the vulnerable who are most adversely affected by shocks such as the COVID-19 pandemic, because this will guarantee public support for the sustainability transition. Business as usual is unsustainable as it increases the likelihood of future shocks. Hence effort needs to be put both on a sustainability transition and on building up capacity for resilience by increasing green inclusive investments as well as stimulating behavior change. The approach argued by OECD is anchored on inclusivity and well-being. The report outlines specific challenges and suggestions for the food, energy, housing, mobility, production and supply chain management sectors.

Implications for infrastructure

According to OECD (2020), there is not a choice between 'quick recovery' or 'build back better' since 'quick recovery' would lock us on the same environmentally destructive path we have been on for decades, which is not sustainable and will come back to seriously threaten our existence in the long run. Therefore, the only real choice is to 'build back better', with investments in infrastructure assets that support the sustainability transition. New infrastructure networks should be built for climate resilience, keeping in mind the inevitable impacts from climate change such as extreme unpredictable weather. While, retrofitting existing infrastructure networks for climate resilience is found to be more costly. Other than this, investment in natural infrastructure is stressed as important along with investments that assess the values of biodiversity and ecosystem services and integrate them into decision-making. Specific recommendations are made for housing, mobility, energy and supply chain-management.

Causal loop and Stock-and-flow diagram

The state of the current crisis imposes both challenges and opportunities, as shown in the causal loop diagram (see Figure 1). The economic downturn, evidenced by falling GDP, has increased the need to government bailouts and economic support. This gives the government the opportunity to significantly stir the direction of economic development. OECD argues that in this weakened position the public is more willing to accept sustainability standards, thereby shifting their behavior, no matter the strictness of the measures. These green government recovery measures will decrease investments in environmentally destructive activities, which despite benefiting immediate economic growth are otherwise destroying natural capital in an unequal way, driving further segregation. This is an issue since segregation reinforces the myopic worldview that advances environmentally destructive activities to begin with. On the other hand, green recovery policies have the potential to improve the state of natural capital and benefit economic growth in the long term.

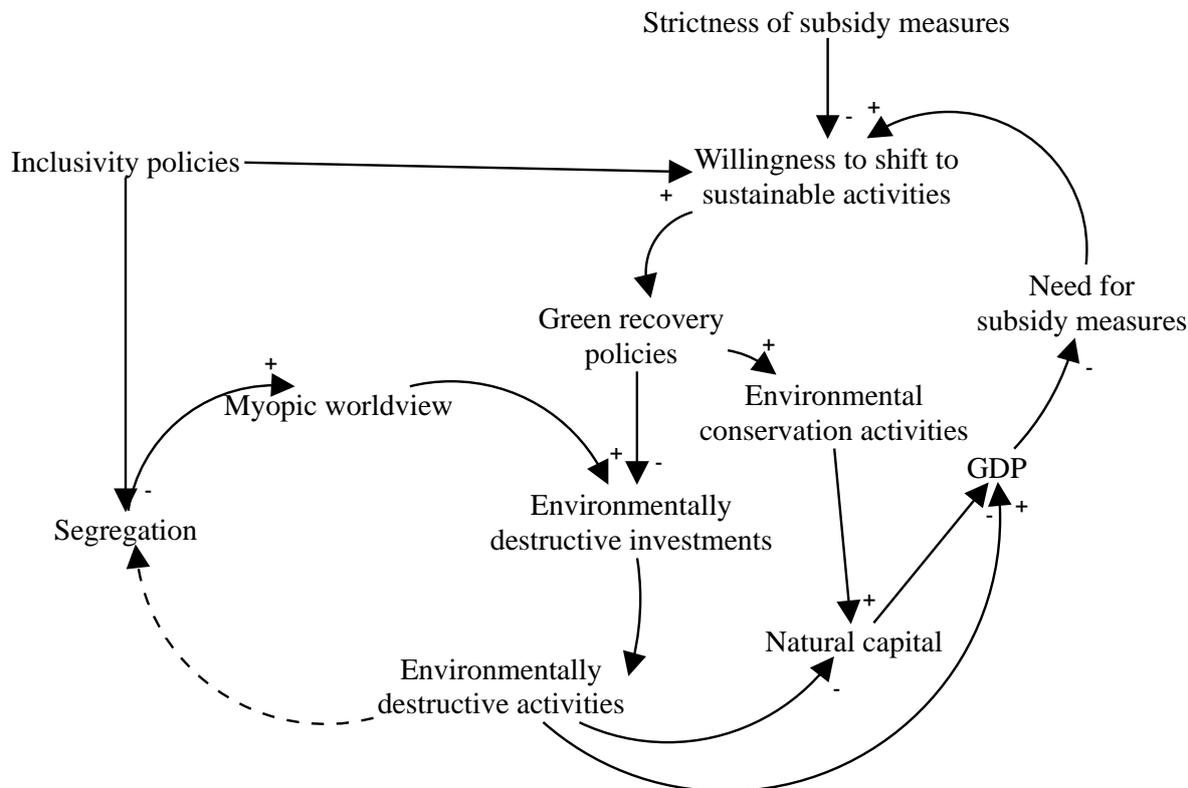


Figure 9. Causal loop diagram based on OECD (2020). The dotted arrows are author assumptions implicit in the text.

The stock-and-flow diagram tells a more detailed story of how some of the sectors are involved in this issue. To begin with, housing quality and neighborhood density are influencing the perceived risk of getting infected with the coronavirus. Thus, the demand for housing has been increasing, which has a negative effect on GHG emissions from housing. This makes it clear that it is ever more important to invest in making sustainable inclusive cities, which enable a sustainable lifestyle despite high population density.

Since energy demand has decreased with the pandemic, now is the time to invest in energy efficiency or energy access policies. These would increase the efficiency of distribution as well as make supply more flexible, which would amount to affordability. More efficient energy production and distribution would also lower emissions from energy, even if the % of renewables use is low.

In terms of mobility, it is important to diversify transport options as this will increase resilience to future shocks. The focus is on making mobility accessible; however, the price of vehicle ownership and public transport can be manipulated to improve overall resilience and accessibility. For now, large distance mobility has decreased while micromobility has increased, it is still uncertain what the working trends will be post-COVID. Road infrastructure needs to account for these changes in behavior as well as stimulate a high occupancy rate for private and public vehicles, decreasing congestion and steering individual choices so as to lower emissions per km.



The pandemic has exposed the vulnerabilities of long complex supply chains and increased the popularity of protectionism. However, OECD argues that caution needs to be taken as it is not necessarily true that shorter supply chains mean lower ecological footprint. Although shorter supply chains do make it easier to increase the circularity of supply chains, thereby boosting resource efficiency and lowering emissions from resource use. Digitalization and automation are also said to decrease emissions and improve resilience to future shocks, although they may come at the price of job loss.

Food production has the largest impact on biodiversity loss, which further increases the likelihoods of future shocks. Biodiversity is also important for maintaining food security as it can ensure food supply despite single crop failure. A similar argument can be made in terms of natural resource security. The stressors for biodiversity are driven through meat consumption, which requires more land to be cleared for agriculture, destroying wild habitats in the process. This, along with the density of livestock populations, increases the risk for zoonotic viruses such as the coronavirus that caused the current pandemic. Not only that, but they also result in grave GHG emissions. Food production productivity can balance out their impact on biodiversity, however not if based on monoculture, which undermines biodiversity. Increasing demand for food production also incentivizes fertilizer use as farmers are forced to resort to it as a means of delivering high yields. But fertilizer use is an additional driver of biodiversity loss due to nutrient run off. There is a hope for increasing biodiversity through initiatives that value ecosystem services monetarily. However, the implementation of methods to assess their values or include them in decision making is lacking.

Reference

OECD (2020) *Building back better: A sustainable resilient recovery after COVID-19*.

<http://www.oecd.org/coronavirus/policy-responses/building-back-better-a-sustainable-resilient-recovery-after-covid-19-52b869f5/>, accessed on 14 October 2020.

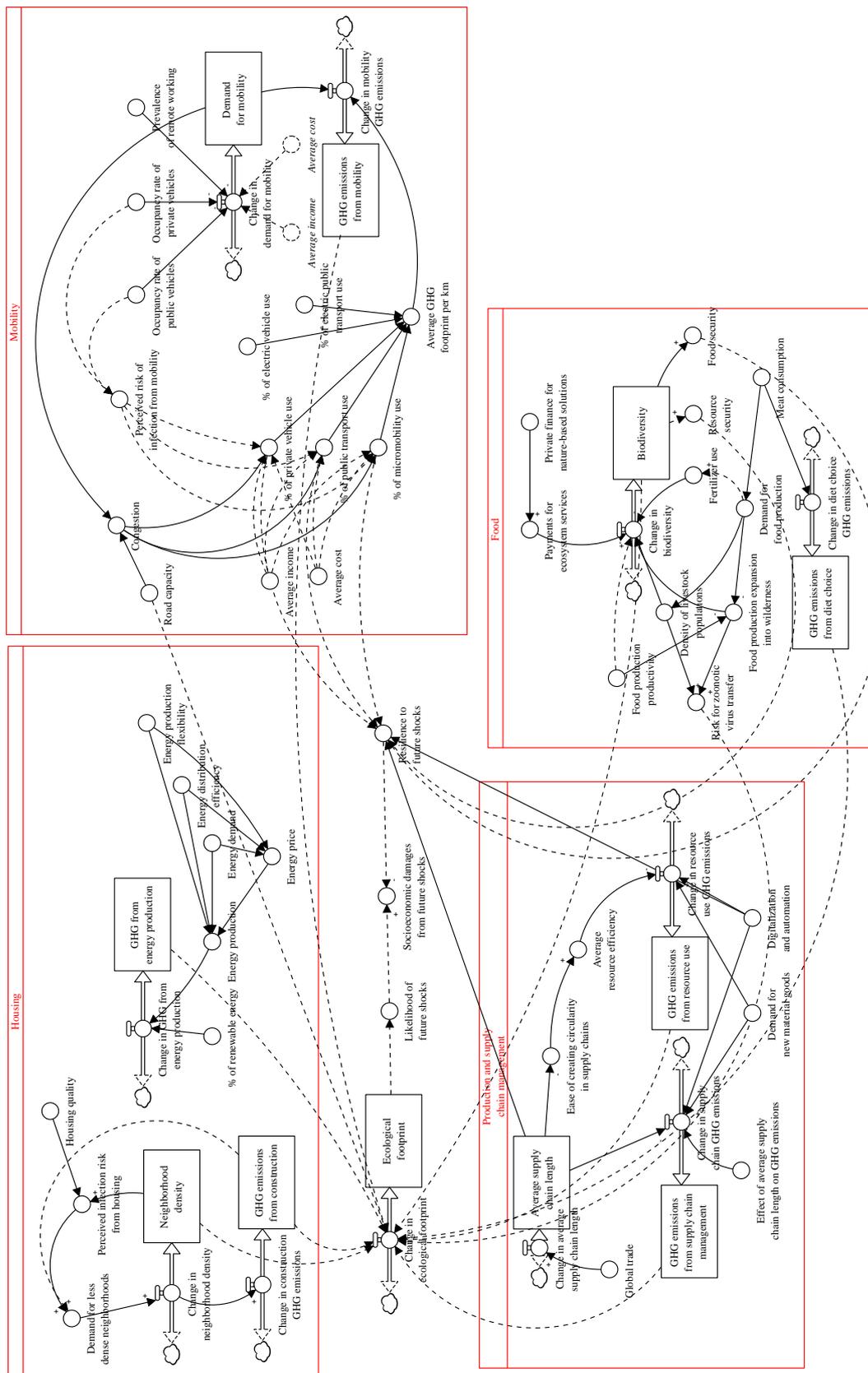


Figure 10. Stock-and-flow diagram based on OECD (2020). The dotted arrows are author assumptions induced from the document.

PBL Netherlands Environmental Agency (2020)

Summary

This report is focused on the effect of the pandemic on efforts to reach the climate goals. It presents a model of the impact of COVID-19 on emissions with an assessment of scenarios and uncertainties. Next, it introduces the debate between ‘green’ and ‘grey’ recovery with a thorough literature review of policy studies applying any kind of index of greenness measure. An example case study of the recovery policies of Germany are given and a final note on how higher green investments and low-carbon assets lower the impact of recovery policies on GHG emissions and lead the way to zero-emissions societies. Lastly, different modeling methods and their suitability to making long-term and short-term recommendations are discussed.

Implications for infrastructure

Infrastructure companies can benefit from the discussion of possible rebound behavior (p. 22). The uncertainty of behavior changes as well as how long those changes will last is a key topic in this report as it drives demand for energy and infrastructure as well as the profitability of ‘green’ and ‘grey’ investments. An example is given on how low energy demand has driven down price and ultimately investments in fossil fuels. Interestingly, investments in renewable energy have been found to be more resilient to the current economic crisis.

Stock-and-flow diagram

The model portrays a clear difference between high-carbon and low-carbon assets and tells the story of how these assets change as a result of consumer behavior, investments and government policy (see Figure 1). Investments in renewable energy drive the conversion of high-carbon assets to low-carbon assets as well as increase the rate at which low-carbon assets are built. On the other hand, investments in fossil fuels increase the rate at which high-carbon assets are built locking-in Dutch society to a carbon future.

The amount and types of assets available and the energy demand determine the carbon intensity of economic activity, which together with the GDP results in GHG emissions (see Table 1). Then, GHG emissions are compared with the NDC forming the Implementation gap, which is assumed to drive green policy thus increasing investment in renewables. Notably, investments are also decided upon by the Anticipated energy demand which, along with the Energy market price, is representative of their respective profitability assuming equal costs.

Last, Energy demand is influenced by changes in behavior (Degree of lifestyle change, Degree of change in mobility and Degree of change in global trade) as well as the Time it takes to develop a vaccine since it is uncertain how many of these changes are permanent and how many might develop in the opposite direction once the pandemic is over. Apart from Energy demand, these changes impact GHG emission rates (see Table 2) in an additional way - through influencing the GDP.

The limitation of this model is that it fails to endogenize behavior change or vaccine development.

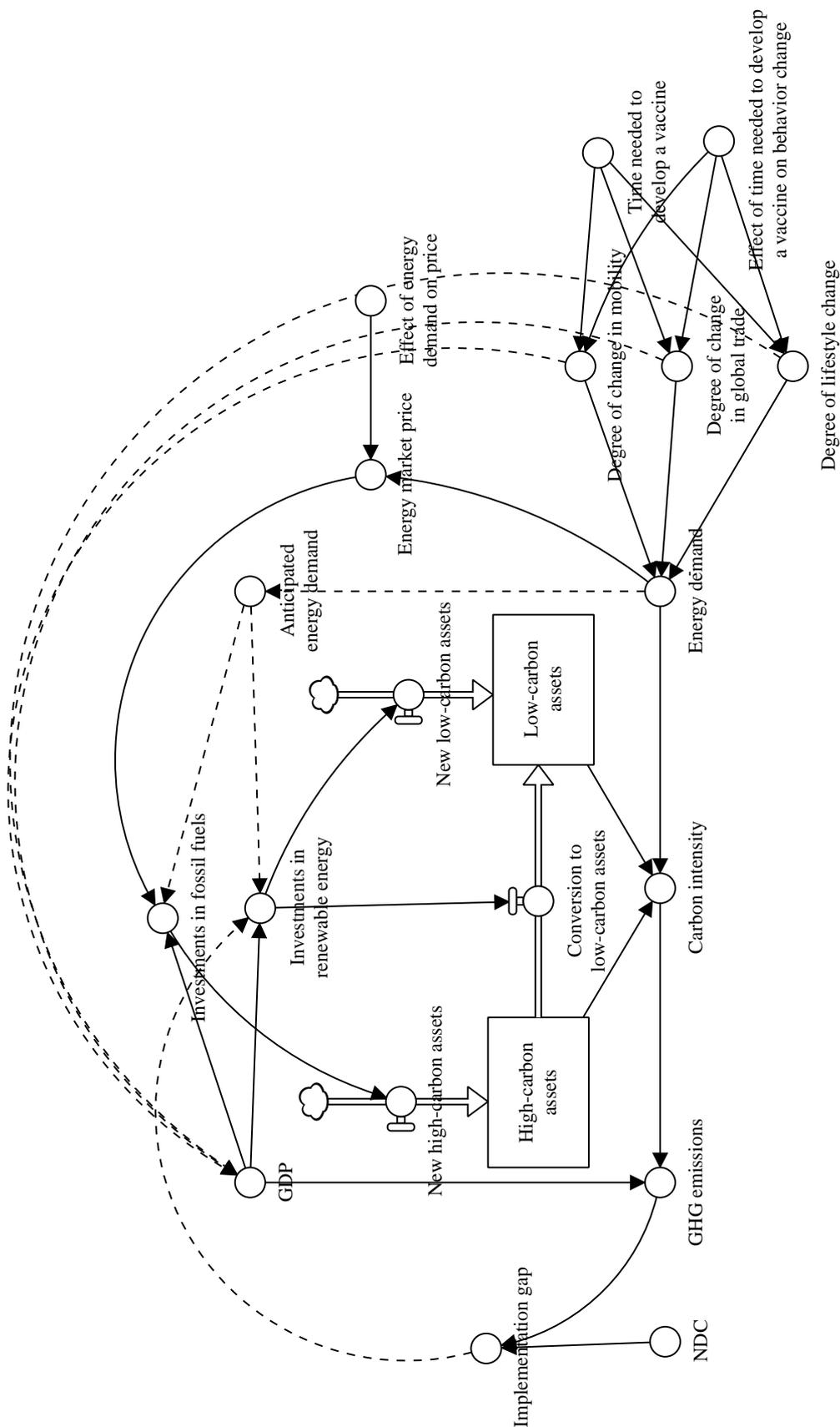


Figure 11. Stock-and-flow diagram based on PBL Netherlands Environmental Assessment Agency (2020)

Variable name	Description	Quote	Page
GHG emissions	Amount of emissions per year	Global emission levels in 2020 will, by most accounts, show the largest annual decline in history	8
Degree of lifestyle change	The extent to which people will change their behavior in terms of demand for infrastructure	The collective understanding is that projections for 2020 (and 2021) heavily depend on ... the degree to which life will resume its pre-confinement course	13
Carbon intensity	The emission rate per GDP	The collective understanding is that projections for 2020 (and 2021) heavily depend on ... carbon intensity of economic activity	13
Demand for renewable energy	Cumulative Kw/H demanded	Demand for renewable electricity has been largely unaffected by the overall fall in energy use	13
Anticipated energy demand	Projections for energy demand	Historical data show that a decrease in emissions caused by a crisis is often followed by an increase in emissions during and after economic recovery.	14
NDC	National determined contribution to the Paris agreement	The pandemic will likely affect NDC emission projections through its effects on GDP growth	18
Emissions gap	The difference in emissions between the NDC and the least-costs pathway.	Thus, the emissions gap in 2030, defined as the difference between projected global GHG emissions in 2030 under the NDC scenarios and emissions under least-costs pathways limiting warming to below 2 °C and 1.5 °C, is expected to remain the same.	19
Implementation gap	The difference in emissions between the NDC and current policies.	Thus, the pandemic is expected to slightly reduce the implementation gap, i.e. the difference between estimated total global emissions in 2030 under the NDC scenarios versus emissions under current policies.	19
Time needed to develop a vaccine	The time needed to develop a vaccine for COVID-19	The full impact of the pandemic on emissions is yet unknown, and will depend on many factors, including the time needed to develop a vaccine	21
Investments in renewable energy	Total amount of money invested in renewable energy	Investments in renewable energy are also uncertain.	21
Anticipated investments in renewable energy	Projections for total amount of money invested in renewable energy	investments in renewable power projects are still expected to fall by 10% in 2020 compared to 2019	21
Investments in fossil fuels	Total amount of money invested in fossil fuels	While this decrease is smaller than the decline observed for fossil fuel investments, which witnessed the largest annual fall in history (around 20%, a decline of about \$400 billion, see IEA, 2020c),	21
Investments in renewables needed to reach a sustainable pathway	Total amount of investments in renewables needed to reach sustainability goals	The flat trend in investments in clean energy and efficiency since 2015 is far from enough to put the world on a more sustainable pathway and bring a lasting reduction in emissions (IEA, 2020c).	21
High carbon assets	The amount of high carbon-emitting physical assets	Greener investments are needed now to avoid a lock-in to carbon intensive energy sources and potential future stranding of high-carbon assets.	23
Energy demand	Cumulative Kw/H demanded	This would require in-depth analyses of the impact of national government policies on energy demand and activity changes.	32
Effect of energy demand on price	The effect of energy demand on energy market price	The sharp reduction in demand for these fuels due to COVID-19 containment measures led to a decline in market prices that, in turn, led to a significant decrease in fossil fuel investment projections.	32
Degree of change in global trade	The extent to which people will change their behavior in terms of demand for non-local goods	Structural changes that can be expressed in terms of ... changes in global trade and consumption patterns, and changes in surface transport due to a greater percentage of the population working from home	33
Degree of change in mobility	The extent to which people will change their behavior in terms of transport usage	Structural changes that can be expressed in terms of ... changes in surface transport due to a greater percentage of the population working from home	33
Effect of time needed to develop a vaccine on behavior change	A variable portraying to what extent the behavior change is permanent vs there being a rebound effect	These factors will determine whether rebound effects at the sector level will be positive or negative in terms of their climate impact.	21

Table 7. A description of the most important variables in the model.

N.	Page	Quote	Causal link
1	21	These factors will determine whether rebound effects at the sector level will be positive or negative in terms of their climate impact.	Time needed to develop a vaccine -> Degree of lifestyle change Time needed to develop a vaccine -> Degree of change in mobility Time needed to develop a vaccine -> Degree of change in global trade Effect of time needed to develop a vaccine on behavior change -> Degree of lifestyle change Effect of time needed to develop a vaccine on behavior change -> Degree of change in mobility Effect of time needed to develop a vaccine on behavior change -> Degree of change in global trade
2	21	In the current crisis, emissions have been reduced in almost every sector except the residential sector	Degree of lifestyle change -> Energy demand
3	23	Greener investments are needed now to avoid a lock-in to carbon intensive energy sources and potential future stranding of high-carbon assets.	Investment in fossil fuels -> High-carbon assets
4	23	Emissions could bounce back and even overshoot previously projected levels by 2030, despite lower economic growth	High-carbon assets -> Carbon intensity -> GHG emissions Low-carbon assets -> Carbon intensity -> GHG emissions
5	32	the COVID-19 containment policies of national governments led to large reductions in global energy demand and CO2 emissions in the first half of 2020.	Energy demand -> Carbon intensity -> GHG emissions
6	32	the sharp reduction in demand for these fuels due to COVID-19 containment measures led to a decline in market prices that, in turn, led to a significant decrease in fossil fuel investment projections.	Degree of lifestyle change -> Energy demand -> Energy market price -> Investment in fossil fuels
7	33	Structural changes that can be expressed in terms of emissions over longer time periods, such as long- term governmental policies, changes in global trade and consumption patterns, and changes in surface transport due to a greater percentage of the population working from home,	Degree of change in mobility-> Energy demand-> Carbon intensity -> GHG emissions Degree of change in global trade -> Energy demand-> Carbon intensity -> GHG emissions

Table 8. Causal links found within PBL Netherlands Environmental Assessment Agency (2020)

Reference

PBL Netherlands Environmental Assessment Agency (2020) *Exploring the impact of the COVID-19 pandemic on global emission projections: Assessment of green versus non-green recovery*
https://www.pbl.nl/sites/default/files/downloads/pbl-new-climate-institute-2020-exploring-the-impact-of-covid-19-pandemic-on-global-emission-projections_4231.pdf, accessed on 8 October 2020.

Raad voor de leefomgeving en infrastructuur (2020)

Summary

This open letter attempts to answer the question about which government measures will be most aligned with a green recovery, supporting both economic recovery and the sustainability transition. The main argument is that there is no tension between these two goals as they both reinforce one another. The letter first sets the background by naming the current infrastructure problems in the Netherlands and listing the changes that have come about as a result of COVID-19. Then, it explores three options for policy makers: status quo, pause sustainability transition projects and intensify sustainability transition. Finally, it advocates to pause sustainability transition projects in mobility and tourism, while engaging other sectors in intensifying the sustainability transition. A list of specific measures is overviewed in each sector.

Implications for infrastructure

There are very specific policy recommendations for housing, energy, mobility, aviation, maritime transport and infrastructure restoration. In addition, the investment in sustainable earning models is stressed, which strengthen the economy in the long-term as well as an equal distribution of measures in all regions.

Stock-and-flow diagram

The model narrates the story of the interrelationships between sustainability transition projects (which can also be thought of as ‘green policies’) and economic growth, mediated by public funds and natural resource quality. Since the letter argues for policy approaches which may impact sustainability projects at a different time in their progress, a distinguishment is made between proposed, running and completed projects.

Completed projects positive affect Dutch natural resource quality, i.e. they reflect well on the natural environment (climate, biodiversity, soil etc.) Further, as argued by the paper, the state of Dutch natural resource quality has a delayed effect on the Dutch GDP growth rate. In turn, the state of the economy, or Dutch GDP growth rate drives Public income through taxation and Government willingness to invest in green recovery policies. Public income increases Public funds and subsequently Public expenditures.

Similarly, Public funds and Change in natural resource quality also affect Government willingness to invest in green recovery policies, which can be emphasized as the central variable in the model. As such, it is an arrayed variable as it aims to capture the government’s overall attitude to sustainability projects along their progress timeline, including the willingness to: (1) accept new projects, (2) intensify completion of running projects and (3) pause completion of running projects. Notably, the Government willingness to invest in green recovery policies is influenced by three different sources of information: Change in natural resource quality, Anticipated change in GDP growth rate and Public funds. It then goes on to affect project acceptance and completion, ultimately affecting the Change in GDP growth rate.

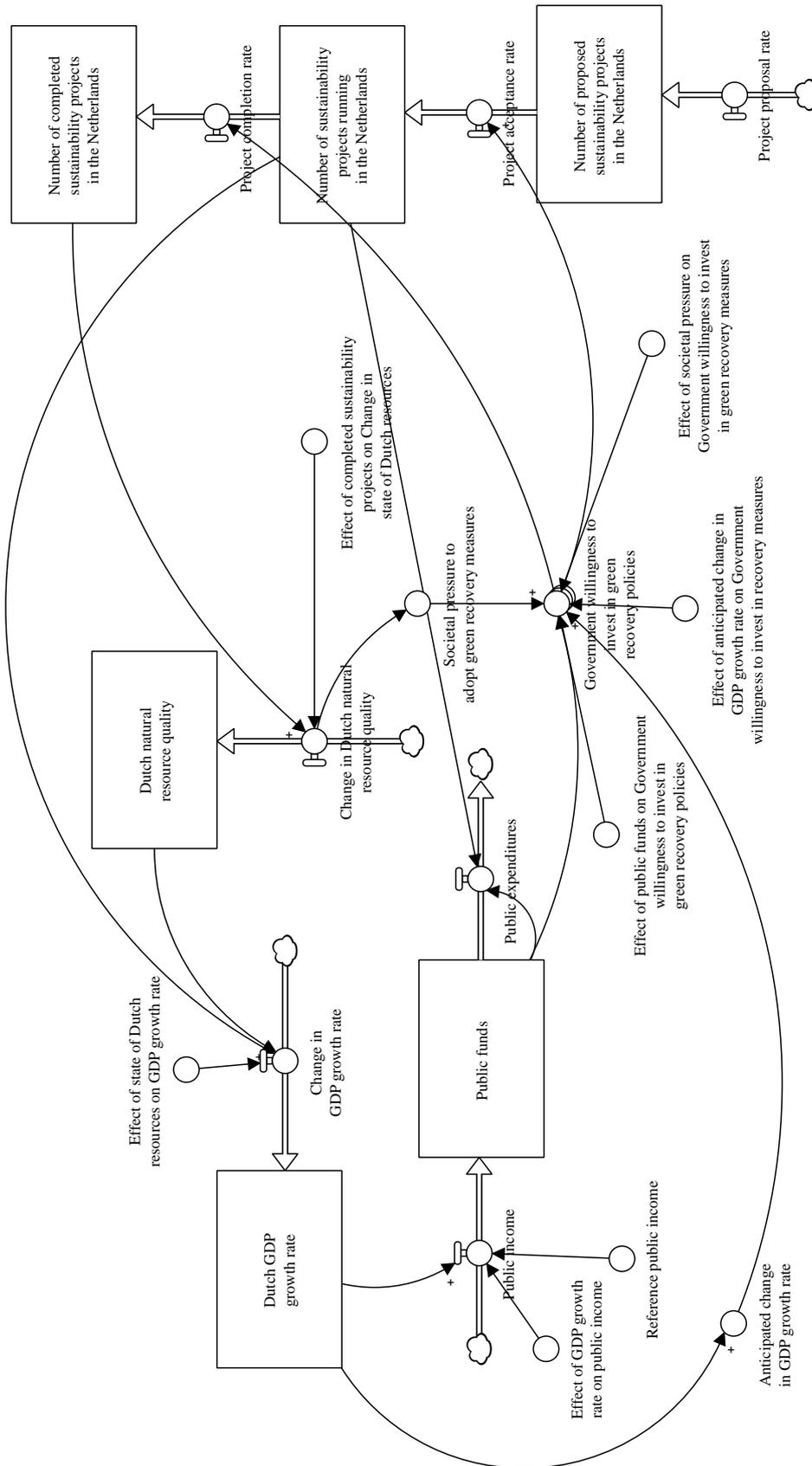


Figure 12. Stock-and-flow diagram based on Raad voor de leefomgeving en infrastructuur (2020)

Apart from the stocks and the central variable (see Table 1), the most interesting variables in the model are those with “Effect” in their name as they are nonlinear variables attempting to describe the exact nature of the causal relationships (see Table 2). Notwithstanding the following variables form a parking lot, i.e. they are yet to be included in the model despite being implied in the letter: Public adaptability, Government policy appraisal, (Changing) social norms and behavior. They are representative of public behavior, which is currently out of the scope of this model.

Variable name	Description	Quote	Page
Dutch natural resource quality	An aggregate variable portraying the state of the natural environment	We are currently at the limits of what our planet can handle. As a result, the climate is changing, biodiversity is declining, and our raw materials are depleted.	3
Government willingness to invest in green recovery	An arrayed variable depicting the government’s attitude and action in regard to sustainability transition projects	The council sees three action perspectives that the national government can consider with a view to economic recovery and sustainable development.	7
Public funds	Funds to be used for investment in projects	A successful green recovery policy requires a mix of investments	6
Dutch GDP growth rate	The GDP growth rate is an indicator of the Dutch economy	The Council realizes that the economic setback that the current crisis is causing in the first place requires effective policy impulses aimed at employment and economic recovery.	26
Number of sustainability projects running in the Netherlands	The number of projects and initiatives already underway for the purpose of fulfilling the SDGs	The council therefore calls for the agenda to emerge green from the crisis to be an agenda for the whole of the Netherlands and thus to tie in with the many initiatives already underway by citizens, companies and social institutions.	27

Table 9. A description of the most important variables in the model.

N.	Page	Quote	Causal link
1	2	However, the council does not intend to prioritize sustainability agendas over economic recovery policies. According to the council, both orientations can actually reinforce each other.	Project completion rate -> Number of completed sustainability projects in the Netherlands -> Change in Dutch natural resource quality -> Dutch natural resource quality ->Change in GDP growth rate -> Dutch GDP growth rate
2	2	However, the council does not intend to prioritize sustainability agendas over economic recovery policies. According to the council, both orientations can actually reinforce each other.	Dutch GDP growth rate -> Public income -> Public funds -> Government willingness to invest in green recovery -> Project completion rate
3	3	These are long-term problems that may seem less urgent in times of pandemic. After all we do not experience its effects every day.	Change in Dutch natural resource quality -> Government willingness to invest in green recovery
4	3	These are long-term problems that may seem less urgent in times of pandemic.	Anticipated change in GDP growth rate -> Government willingness to invest in green recovery
5	4	Just like the corona virus, all these sustainability challenges will have a drastic effect on the economy.	Change in Dutch natural resource quality -> Change in GDP growth rate
6	7	The council sees three action perspectives that the national government can consider with a view to economic recovery and sustainable development.	Government willingness to invest in green recovery -> Project completion rate Government willingness to invest in green recovery-> Project acceptance rate

7	26	The Council realizes that the economic setback that the current crisis is causing in the first place requires effective policy impulses aimed at employment and economic recovery.	Number of sustainability projects running in the Netherlands -> Change in GDP growth rate Number of sustainability projects running in the Netherlands -> Public expenditures
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Table 10. Causal links found within Raad voor de leefomgeving en infrastructuur (2020)

Reference

Raad voor de leefomgeving en infrastructuur (2020) *Groen uit de crisis*

<https://www.rli.nl/publicaties/2020/advies/groen-uit-de-crisis>, accessed on 7 October 2020.

Sociaal & Cultureel Planbureau, Planbureau voor de Leefomgeving, Centraal Planbureau (2020)

Summary

The planning bureaus have collaborated on spreading the message that policy making should look beyond economic recovery to issues such as climate change and growing social divide. The message from their advisory letter is to carefully align short term policy actions with a long-term development agenda. In addition, there is a strong call for customized policy making approach as social groups and regions differ greatly.

Implications for infrastructure

Instead of crisis decision-making, the letter urges long-term investments. The emphasis should be put not only on economic recovery, but also on the living environment and society. As such, the disproportionate effects of the crisis need to be addressed with structural changes that will impact systemic inequalities. Further, the climate goals should be a focal point and another drive for systemic innovation.

Causal loop diagram

The story of the diagram is that broad short-term policies, that is focused on economic recovery in addition to improving pressing problems in Dutch society such as housing quality, quality of life, natural capital and social cohesion should build up to accomplishing long-term policy goals. Whereas general narrow-targeted policies tend to have a myopic view which often goes against the long-term goal of solving these problems (see Figure 1).

Adopting the metaphor from the ‘Shifting the burden’ systems archetype, when Dutch society is further away from its long-term goals then it is that much less likely that broad short-term policies will be adopted since the situation then will be even more urgent possibly as a result of a new crisis.

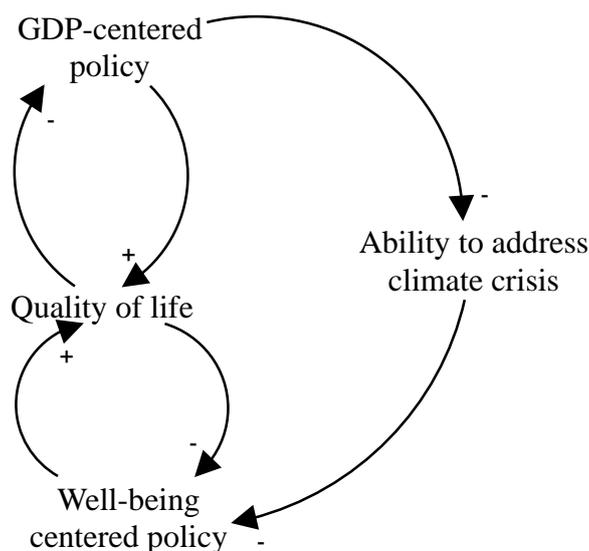


Figure 13. Stock-and-flow diagram based on Sociaal en Cultureel Planbureau, Planbureau voor de Leefomgeving & Centraal Planbureau (2020).

N.	Page	Quote	Causal link
1	3	At the same time, tensions can arise between short and long-term effects	Narrow short-term policy -> Long term policy implementation -> Broad short-term policy
2	2	More than ever, it is relevant to apply a broad prosperity perspective when assessing measures.	Broad short-term policy -> Quality of life -> Broad short-term policy
3	6	The planning offices therefore advise not to emphasize a necessary situation for the short term, but rather the desirable long-term perspective of a healthy, resilient and sustainable society.	Narrow short-term policy -> Quality of life -> Narrow short-term policy

Table 1. Causal links found within Sociaal en Cultureel Planbureau, Planbureau voor de Leefomgeving & Centraal Planbureau (2020)

References

Sociaal en Cultureel Planbureau, Planbureau voor de Leefomgeving & Centraal Planbureau (2020) Aandachtspunten voor een herstelbeleid: Briefadvies Covid-19 Overleg Planbureaus. <https://www.scp.nl/publicaties/publicaties/2020/05/28/aandachtspunten-voor-een-herstelbeleid-briefadvies-covid-19-overleg-planbureaus>, accessed on 26 October 2020.

Marika Stellinga (2020, October 8) Planning bureaus to cabinet: 'just extinguishing the corona fire is not enough', NRC. Retrieved from <https://www.nrc.nl/nieuws/2020/10/08/kabinet-alleen-de-coronabrand-blussen-is-niet-genoeg-a4015277>

Summary

This research describes the developments of institutional trust, redistribution preferences, feelings of solidarity, social trust, discrimination and stigmatization among the Dutch during the pandemic. It draws from research on similar crises such as natural hazards (earthquakes), economic crises (2008 and 1930s) and security crises (MH17 and 9/11); and outlines probable future developments. In summary, the COVID-19 pandemic has increased institutional trust and preferences for redistributive politics since the vulnerable are seen to be especially unlucky during this crisis. Moreover, it has increased feelings of solidarity, which can be attributed to media messaging that the virus can only be battled collectively. However, it has also increased discrimination and stigmatization as people connected to COVID-19 hotspots have experienced more discrimination compared to pre-COVID-19. But the research points that these effects are likely to last only as long as the pandemic, however long that may be, after which they are bound to return to normal. The effects are deemed to be most durable for the youth which are going through their formative years during this crisis, affecting the political views of these generations in the long term.

Implications for infrastructure

Infrastructure companies should not pay too much attention to shifting public opinions as these are likely to last only as long as the ongoing health and economic crisis. Although, short-term increases in conservatism may affect immigration policy which can be important for labor supply. The only certainty is the aging population accompanied by varying intergenerational solidarity. Therefore, infrastructure policies should show sensitivity to these issues, ensuring that the way infrastructure is managed and built is friendly to all generations.

Stock-and-flow diagram

The spread of the COVID-19 pandemic is modelled using SIR (susceptible, infected and recovered) structure (see Figure 1). Central to this model is the variable regarding institutional trust. The pandemic has had positive effects on institutional trust as citizens have responded favorably to government actions and the visibility of politicians on the media (see Table 1). This, in turn, affects the government's ability to control the crisis, as there is less resistance to government preventative measures.

Institutional trust is important in addition to enabling government intervention because it increases the feeling of solidarity among citizens, thus boosting social cohesion and promoting overall stability of the social order. At the same time, it balances out the negative effects of stigmatization and discrimination.

Beyond the health crisis, the economic crisis, evidenced by a decreasing amount of available economic resources, has had a positive effect on institutional trust and feelings of solidarity. In times of crisis, the vulnerable are seen as less responsible for their economic shortcomings, thus preferences for redistribution rise albeit temporarily. Institutions are also looked at more favorably since they hold the key for unlocking the economic crisis.

Lastly, COVID-19 prevalence affects feelings of solidarity in two different ways. First, it increases feelings of solidarity since the uncertainty and tragedy of the situation inspires empathy and collective action. But, at the same time, the prevention measures have inspired shifts in lifestyle that increase conservatism and thus increase discrimination, ultimately negatively affecting social cohesion. The research proposes that the government and media can navigate these effects by emphasizing the importance of collaboration for exiting this crisis. As an example, views on immigration have been more favorable during the pandemic presumably because there has been less negative press on the issue since the focus has been on the pandemic.

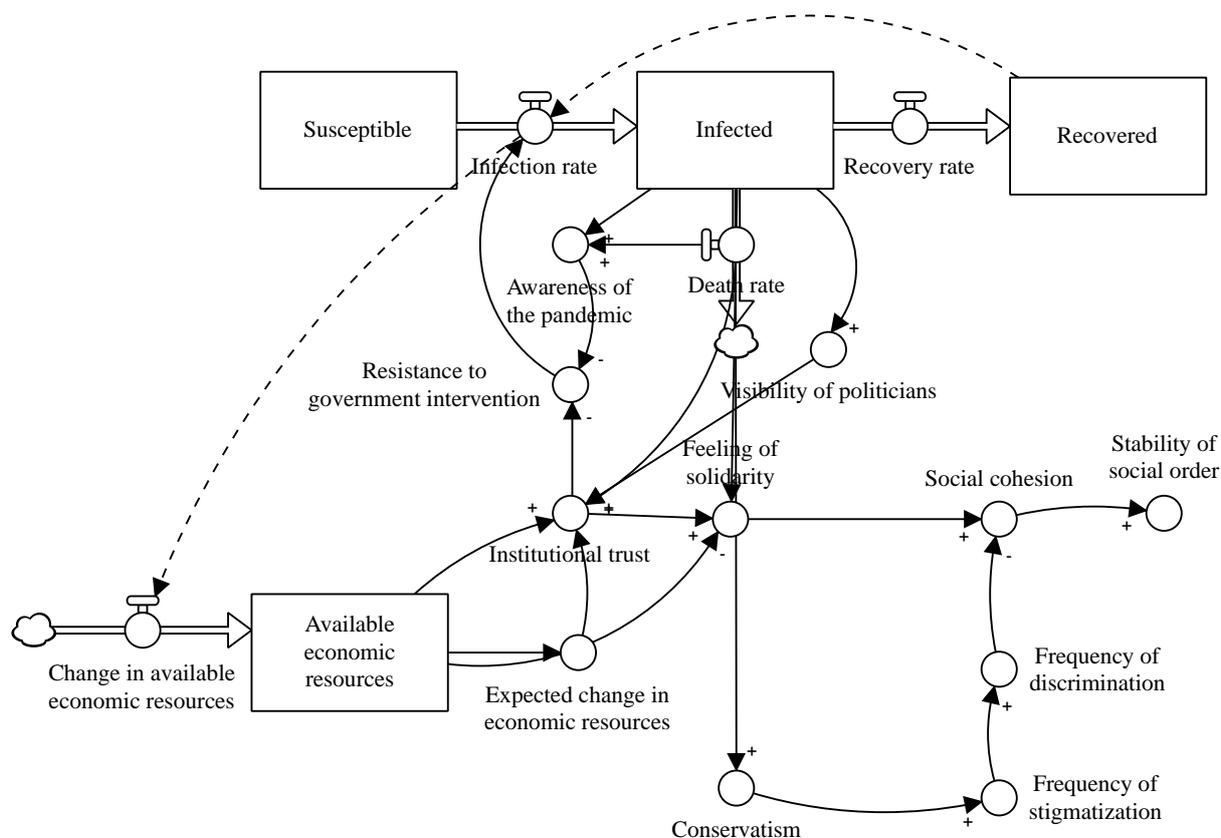


Figure 14. Stock-and-flow diagram based on *Sociaal en Cultureel Planbureau (2020)*. The dotted arrow is an assumption induced from the document.

N.	Page	Quote	Causal link
1	1	At the beginning of this year, the Netherlands was hit by the corona virus, which resulted in many infections in a short time and deaths.	Susceptible -> Infection rate -> Infected -> Recovery rate -> Recovered -> Infection rate Susceptible -> Infection rate -> Infected -> Death rate
2	2	Also trust, solidarity and commitment between people mutually are indicative of greater social cohesion, which in turn can be conducive to social order, stability and security and the maintenance of collective provisions in a country.	Feeling of solidarity -> Social cohesion -> Stability of social order
3	2	An increase discrimination and stigmatization can actually put this social cohesion under pressure	Frequency of stigmatization -> Frequency of discrimination -> Social cohesion
4	4	Then in January the virus in China rage, few people were worried about corona. The call for preventive measures was not strong and strong government intervention probably would have met with resistance.	Infected -> Awareness of pandemic -> Resistance to government intervention Death rate -> Awareness of pandemic -> Resistance to government intervention
5	4	The spread of the virus for the time being reasonably under control.	Infected -> Awareness of pandemic
6	4	An (expected) change in resources (for example, the loss of a job) due to corona (measures) can also influence the views and attitudes towards institutions, policy and each other.	Available economic resources -> Expected economic resources -> Institutional trust Available economic resources -> Expected economic resources -> Feeling of solidarity
7	6	A reduced trust in political and social institutions (such as the House of Representatives or the judiciary) can lead to a loss of legitimacy among citizens and vice versa.	Institutional trust -> Feeling of solidarity
8	6	A sufficient basis of political and institutional trust currently determines the extent to which a society succeeds in curbing the spread of the virus.	Institutional trust -> Resistance to government intervention -> Infection rate
9	9	Trust in politics and institutions in democracies rises quite quickly after, for example, a terrorist attack, a natural disaster or an airplane disaster.	Death rate -> Institutional trust
10	9	Greater visibility of the Prime Minister or President through national speeches may also explain the increased confidence.	Infected -> Visibility of politicians -> Institutional trust
11	9	Schraff (2020) argues that it is not so much government intervention, but the development of the number of corona infections that determines confidence.	Death rate -> Institutional trust Infected -> Visibility of politicians -> Institutional trust
12	11	In the longer term an economic crisis (higher unemployment rates, reduced economic growth) will have a negative impact on confidence in institutions and politics: disappointing economic performance generally leads to a decline in political confidence.	Available economic resources -> Institutional trust
13	12	We can expect that people will be more in favor of redistribution in the short term due to the corona crisis, but future research must show whether this is the case and how long it will last	Infected -> Feeling of solidarity
14	14	The unemployed are seen as more deserving of support during an economic crisis, because the blame for unemployment is often beyond their control, while in boom times the unemployed may be held more responsible for not having a job.	Available economic resources -> Feeling of solidarity
15	15	This turning inward manifests itself not only literally in social distancing, but also mentally in a decline in tolerance and openness during an epidemic (Schaller and Murray 2008). This translates into, among other things, an increase in divergent conservative views, such as a more negative attitude towards immigration	Infected -> Conservatism -> Frequency of stigmatization
16	19	People with more institutional trust often also have more trust in their fellow human beings	Institutional trust -> Feeling of solidarity
17	20	People are more likely to turn to the in-group, which increases social exclusion, which can manifest itself in discrimination.	Conservatism -> Frequency of stigmatization -> Frequency of discrimination
18	21	It can be expected that the corona crisis will also lead to an increase in discrimination	Infected -> Conservatism -> Frequency of stigmatization -> Frequency of discrimination

Table 1. Causal links found within Sociaal en Cultureel Planbureau (2020)



Reference

Sociaal en Cultureel Planbureau (2020) *Socio-cultural consequences of corona: Expected consequences of corona on views and attitudes of the Dutch.*

<https://www.scp.nl/publicaties/publicaties/2020/07/17/verwachte-gevolgen-van-corona-voor-de-opvattingen-en-houdingen-van-nederlanders#>, accessed on 21 October 2020.

Sociaal Economische Raad (2020)

Summary

This article addresses diversity and inequality within the economic crisis, as well as how that might come back to adversely affect the economy. Not surprisingly, the measures advocated by Sociaal Economische Raad (2020) are rooted in inclusivity. The article paints a picture of a future of sustainable prosperity, which is not necessarily a future of high GDP, but rather a future built on sustainability and inclusivity principles.

Implications for infrastructure

According to this article, infrastructure needs to be inclusive of vulnerable groups who do not have income and social security as others to. And so, infrastructure should be adapted to take care of the specific needs of these groups. Apart from obviously investing in sustainability, infrastructure should cater to elderly, youth, women or those with unconventional jobs such as free lancers, flexi or seasonal workers.

Causal loop diagram

The simple causal loop diagram (see Figure 1) offers a very general look at the economy with special emphasis on its connection to healthcare and the role of vulnerable groups of citizens. The purple variables are the 10 policies suggested by Sociaal Economische Raad (see Table 1). The crisis has shrunk the total money spent on consumption as well as the money spend on production, thus stopping the impact of the reinforcing loop that is usually driving economic growth (see Table 2). Undoubtedly, it has impacted the confidence people have in economic development and prosperity, further debilitating the chance for economic recovery. Although, the article states that the Dutch are found to be generally pessimistic about their economic future even in times of low unemployment and prosperity.

This is especially important for vulnerable groups as the article repeatedly emphasizes that they have been hit hardest, which further undermines confidence about the economic future at least for these groups. The healthcare standard and the economy are said to reinforce one another, which is clear during this pandemic as the pandemic has lowered the health standard, urging lockdown measures that have crippled the economy. Not only that, but the open nature of the Dutch economy has increased sensitivity to international shocks despite previously boosting economic growth through increased trade. Last, the Dutch have high private debts, which has historically been shown to correlate with slower economic recovery due to the burden it has on economic spending.

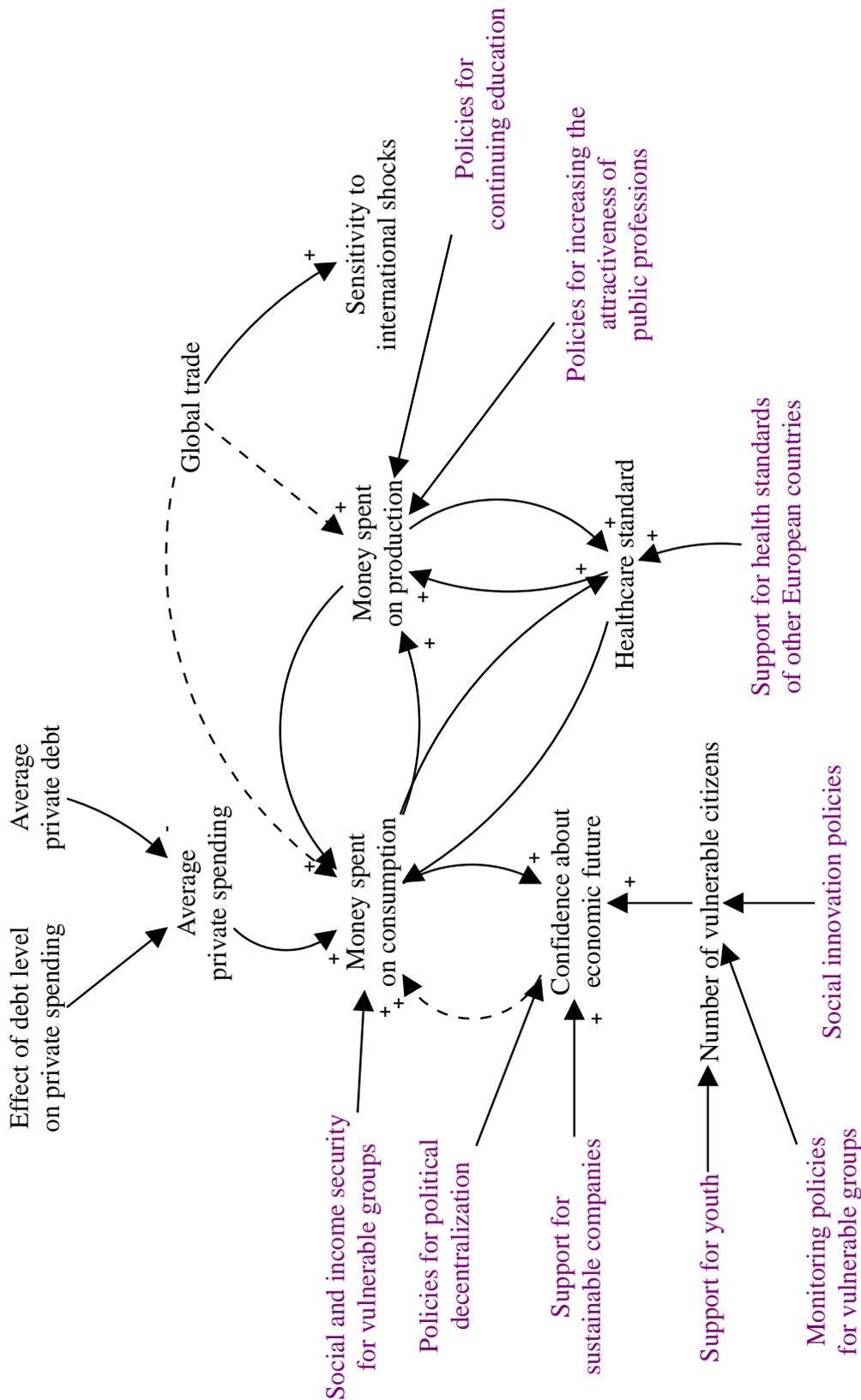


Figure 15. Stock-and-flow diagram based on *Sociaal Economische Raad (2020)*. The dotted arrow is an assumption induced from the document.

In light of this, 10 policies are proposed. Most of them aim to track the development of vulnerable groups and improve their situation through special social and income policies. On a broader scale, the same inclusivity argument is used to support less developed countries, which can be thought of vulnerable groups within a larger European context. Back to the Netherlands, policies promoting continuing education and improving the attractiveness of public jobs are proposed to stimulate the labor market. Finally, there are calls for political decentralization, which would aid customization and adaptability.

N.	Variable name	Description	Quote
1	Support for sustainable companies	Economic support for companies leading the way to a sustainable digital future	It is important that support for specific companies is in line with transitions in the field of energy, climate and digitization.
2	Social innovation policies	Economic support targeted towards vulnerable groups.	It is important that the government continues to support vulnerable groups, companies and sectors. Social innovation, for example by closely involving employees in changes, increases the chance of success.
3	Support for healthcare standards in other European countries	Economic support for healthcare in less developed countries	It is important that the corona virus is effectively combated in all countries, including countries with less money and a less developed health system.
4	Policies for continuing education	Policies aimed to aid and stimulate training and re-training	The Netherlands has invested in strengthening the learning culture, partly in response to the crisis of 2008.
5	Support for youth	Policies to help youth overcome the challenges arising from the COVID-19 crisis	It is important to support and make sustainable initiatives such as the 'homework buddy' - in which a student and an adult are linked - to make them sustainable.
6	Social and income security for vulnerable groups	Social and income security measures for vulnerable groups	The crisis therefore requires the social partners and the government to take energetic action on a new agenda for the labor market and social security.
7	Monitoring policies for vulnerable groups	Policies that monitor the development of new vulnerable groups	It is important that (new) vulnerable groups are monitored
8	Policies for increasing the attractiveness of the public sector	Policies that increase the appreciation of public jobs	This can be a basis for improving public services and thus also making the public sector a (more) attractive employer.
9	Policies for political decentralization	Policies that distribute money and power to the local level	Customization is needed: the countryside requires different solutions than the city. It is therefore important that the national government gives municipalities policy scope, for example with broader powers or room for experimentation. In addition, the national government has the task of adequately compensating municipalities for the extra costs they incur in the recovery phase.
10	Policies to prepare for future crisis	Policies to plan reactions to future societal shocks	The Netherlands needs to be better prepared for a new revival of the current corona virus or a future pandemic. This preparation also includes an assessment framework that can be used in a future crisis situation to make assessments about quality of life, social consequences, health care effects and economic effects

Table 11. A description of the proposed policies.

Quote	Causal link
Companies and institutions produce less and offer fewer services, consumers postpone large purchases and spend only a fraction of their previous budget on catering and holidays	Money spent on consumption -> Money spent on production Money spent on production -> Money spent on consumption
Everyone's confidence in the future is getting a big blow.	Money spent on consumption -> Confidence about economic future Confidence about economic future -> Money spent on consumption
With its open economy, the Netherlands is extra sensitive to international shocks.	Global trade -> Sensitivity to international shocks Global trade -> Money spent on production Global trade -> Money spent on consumption
The Dutch have relatively high private debts, mainly due to mortgages. As a result, consumer spending falls faster and longer than in other countries in a recession	Average private debt -> Average private expenditure -> Money spent on consumption Effect of debt level on private spending -> Average private expenditure
Healthcare and the economy are not in competition with each other, but exist in mutual dependence: a healthy economy cannot exist without good healthcare and vice versa.	Money spent on production -> Healthcare standard Healthcare standard -> Money spent on production Money spent on consumption -> Healthcare standard Healthcare standard -> Money spent on consumption
Various studies have shown in recent years that many Dutch people feel insecure and have concerns about the future, despite the economic boom and low unemployment.	Number of vulnerable citizens -> Confidence about economic future

Table 12. Causal links found within Sociaal Economische Raad (2020)

Reference

Sociaal Economische Raad (2020) *Denktank: 10 bouwstenen voor herstel na coronacrisis*.

<https://www.ser.nl/nl/thema/aanpak-coronacrisis/publicaties/bouwstenen-voor-herstel>, accessed on 13 October 2020.

TNO (2020)

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.

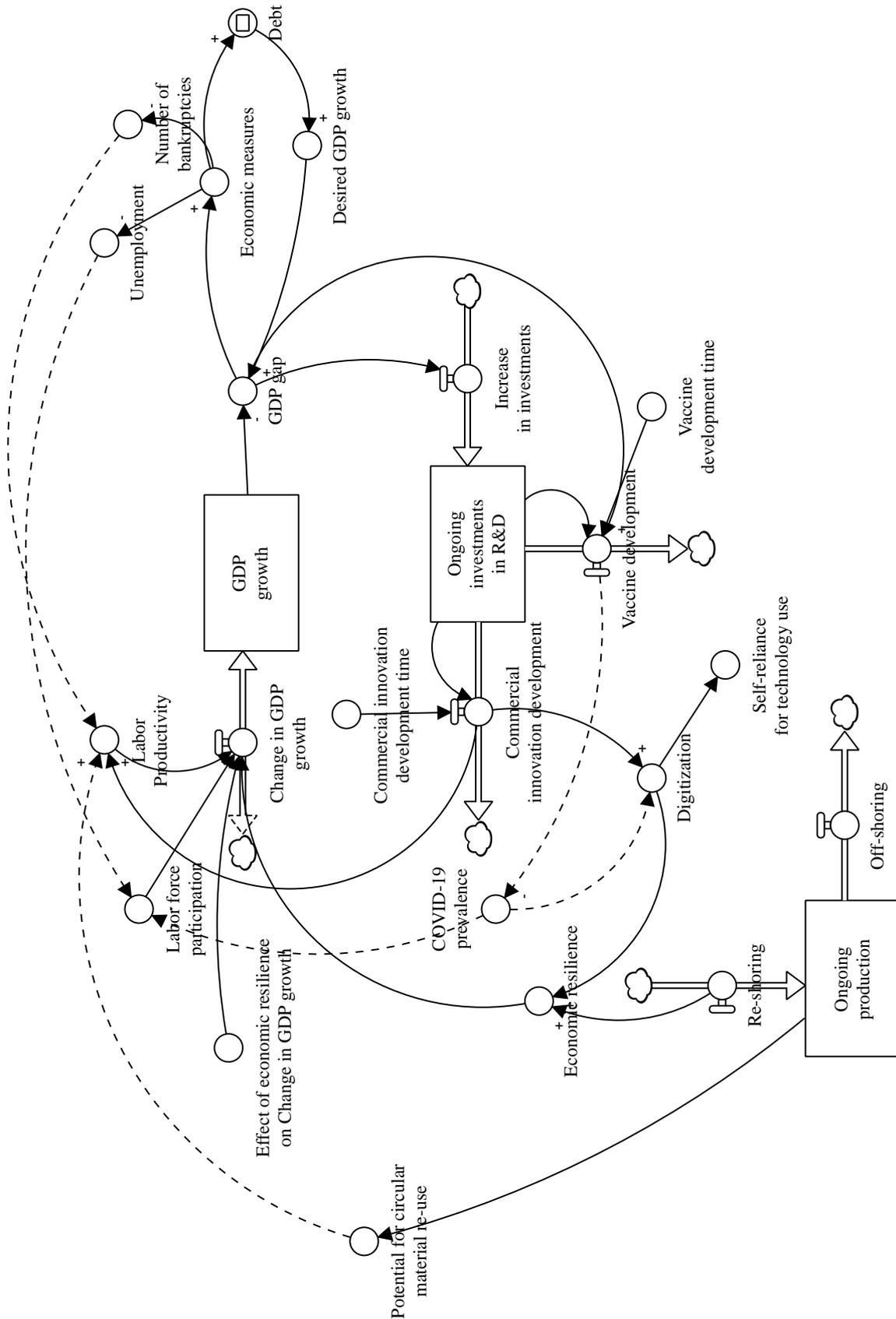


Figure 16. Stock-and-flow diagram based on TNO (2020). The dotted arrows are assumptions induced from the document.

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.

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)

Reference

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.

World Economic Forum (2020)

Summary

The crisis has accelerated pre-COVID economic trends such as the rise of the digital economy and protectionism in developed nations as a reaction to the rise of China. It is inevitable that global economies are in for a deep prolonged recession, which will disproportionately affect marginalized groups. Before the second wave there were early signs of recovery as consumer levels slowly returned to pre-COVID values, which has caused for optimistic investment and market forecasts. The report summarizes the economic outlooks of the WEF's community of chief economists. There was agreement that unemployment figures, although offset by government subsidies, are most indicative of medium-term economic development. Further, disruptions in global supply chains will reverse international economic convergence, which means that emerging economies need to reconsider their growth models. Unfortunately, they predicted contractions in innovation funds, which will undermine global economic growth potential. Last, there is little agreement that the ESG agenda will remain relevant, although most policy making is focused solely on GDP recovery, which is more in line with a 'quick recovery' rather than a 'green recovery'.

Implications for infrastructure

The report outlines three emerging themes. There is wide agreement for the need to create progressive tax architectures to limit the effect of the crisis on inequality. Next, there is little consensus on the role of government in promoting innovation processes. Last, there is agreement that policies should be targeted at growth sectors specifically rather than protecting all jobs. Therefore, infrastructure companies can follow these trends by re-thinking how to limit inequality, invest in innovation and pivot to businesses areas with growth potential through re-training schemes.

Stock-and-flow diagram

The model is divided into three sectors according to the three challenges mentioned by World Economic Forum (2020). First, in terms of inequality and social mobility (see Figure 1) a distinction is made between high skilled and low skilled workers as well as their income. Low skilled workers typically have lower income and therefore get stuck in a 'poverty' loop where they are unable to invest in re-training even though automation has made their work somewhat redundant. The current economic crisis has disproportionate effects on low skilled workers and on other marginalized groups who may find themselves in this kind of vicious loop. The report advises that this gap needs to be addressed through progressive taxes architecture so that the burden is not shared equally because it is not distributed equally in the first place. Similarly, the burden is felt more by youth or flexi workers as those are typically with temporary work contracts and have not received as much support through measures as workers with permanent placements, pointing the finger at another widening divide. Therefore, the report proposes a shift to enlarge policy making to address the full scope of labor supply including transitions between employers, continuous learning and support during periods of inactivity.

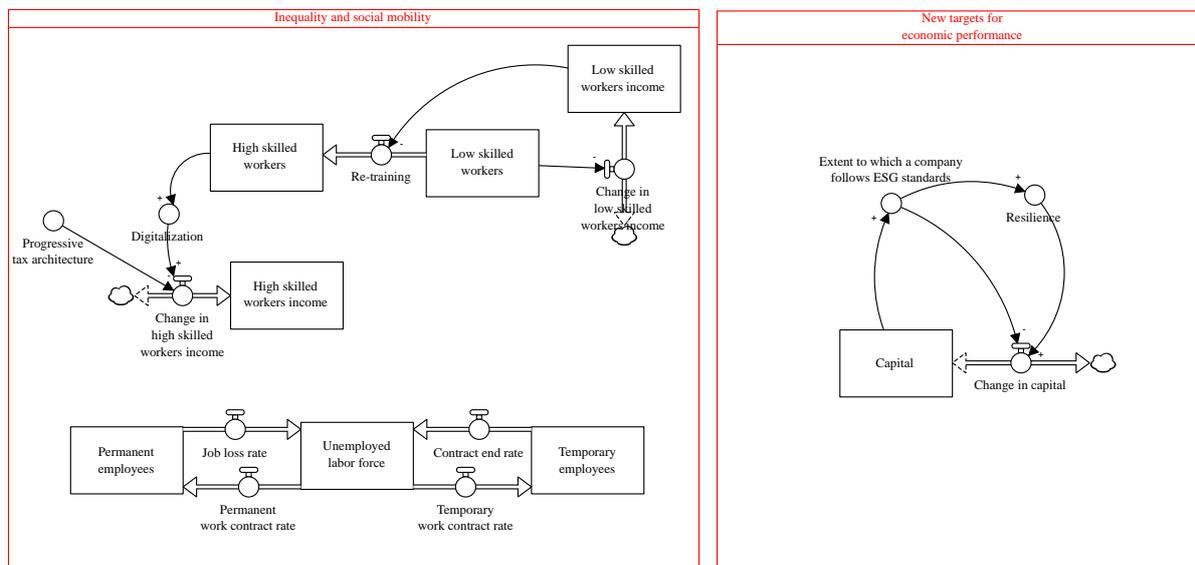


Figure 17. Stock and flow model based on World Economic Forum (2020)

Next, the challenge of new sources of economic growth is analyzed (see Figure 2). The World Economic Forum is a strong supporter of stakeholder capitalism and investment in a new economy which values natural and human capital as much as financial capital. Despite the gloomy outlook on R&D financing during this crisis, they stress that such funds together with investments in new infrastructure are key to shifting to a new economy and unlocking the potential for sustainable growth. Both public and private actors have a role to play in this as they can multiply one another's actions, which is evident in the reinforcing loops.

The crisis has amplified protectionism trends, which were already taking place pre-COVID. Economists argue that it will halt international economic convergence by disrupting old growth models. While in the past companies offshored manufacturing to developing countries because of cheaper labor cost, thereby boosting developing countries GDP, automation and protectionism has slowed down this trend. In addition, concern over supply chain resilience is also expected to put a strain on such offshoring and disrupt developing country economic growth. However, at the same time, there is a new opportunity brought by the COVID-19 crisis and that is the possibility to offshore services and office work. The crisis has accelerated the trend of adoption of remote work, which open up the possibility of a new growth model for developing countries – one based on human capital – which may still contribute to maintaining the trend of international income convergence.

Finally, the World Economic Forum is a proponent of new targets for economic performance as they argue that a shift in metrics can cause a shift in decision-making in the direction of promoting business resilience (see Figure 1). This is supported by the finding that companies that have adopted the ESG framework have been more resilient to the crisis than those that have not (see Table 1).

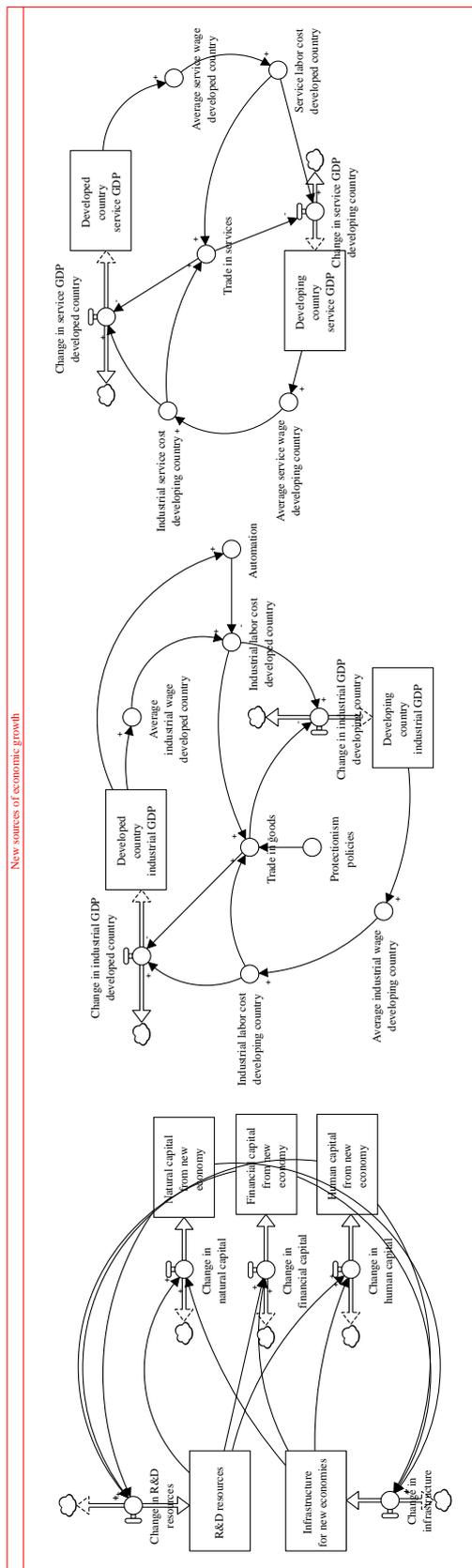


Figure 18. Stock-and-flow diagram based on World Economic Forum (2020). The dotted arrow is an assumption induced from the document.

N.	Page	Quote	Causal link
1	9	Inequality has been accelerating in recent years, in part as technological change has driven a wedge between high- and low-skilled workers and given rise to network effects that have unleashed winner-take-all dynamics across a number of industries.	Low skilled workers -> Retraining -> High skilled workers Low skilled workers -> Change in low skilled workers income -> Low skilled workers income -> Re-training -> Low skilled workers
2	9	In the case of high-income economies, the broad adoption of digital technologies has compounded country-level inequality patterns shaped by the forces of global integration.	High skilled workers -> Digitalization -> Change in high skilled workers income -? High skilled workers income
3	10	A world in which coronavirus debts are repaid by a wealth tax or a global crackdown on corporate tax havens would look very different from one in which benefits are slashed and VAT is raised	Progressive tax architecture -> Change in high skilled workers income
4	10	The COVID-19 crisis descended on labour markets at a time when conditions for workers were already under strain from automation and the number of jobs without permanent contracts and benefits was growing.	Unemployed labor supply -> Temporary work contract rate -> Temporary employees -> Contract end rate -> Unemployed labor supply
5	11	Policy attention needs to shift from jobs alone to consider the full evolution of working lives today, including transitions between employers, continuous retraining, upskilling and life-long learning, as well as support during periods of inactivity.	Unemployed labor supply -> Permanent work contract rate -> Permanent employees -> Job loss -> Unemployed labor supply
6	11	The economic contraction cannot be expected to spare resources allocated to R&D, despite the fact that innovation has never been more critical than at this current juncture to manage climate change and expand opportunity for all.	Change in R&D resources -> R&D resources -> Natural capital -> Change in R&D resources Change in R&D resources -> R&D resources -> Human capital -> Change in R&D resources
7	11	Inclusive and sustainable growth powered by lower resource use will be necessary to pay down unprecedented public and private debt burdens.	Change in R&D resources -> R&D resources -> Financial capital -> Change in R&D resources
8	11	The crisis could also result in long-term damage to trading ties between high- and low-income countries,	Industrial labor cost developing country -> Trade in goods -> Change in GDP developed country Industrial labor cost developed country -> Trade in goods -> Change in GDP developing country
9	12	These are all areas where the use of technology and market forces could have a transformative impact on economies and societies through multiplier effects on employment, social capital and environmental returns; yet, some of the necessary preconditions for these markets to function are lacking.	Change in infrastructure for new economies -> Infrastructure for new economies -> Natural capital -> Change in infrastructure for new economies Change in infrastructure for new economies -> Infrastructure for new economies -> Human capital -> Change in infrastructure for new economies Change in infrastructure for new economies -> Infrastructure for new economies -> Financial capital -> Change in infrastructure for new economies
10	12	Globalization has been among the most important drivers of international income convergence in recent decades.	Developed country industrial GDP -> Average industrial wage developed country -> Industrial labor cost developed country -> Change in industrial GDP developing country -> Developing country industrial GDP -> Average industrial wage developing country -> Industrial labor cost developing country -> Change in industrial GDP developed country -> Developed country industrial GDP
11	12	As routine tasks could increasingly be automated, it became cheaper to repatriate them to headquarter countries	Developed country industrial GDP -> Automation -> Industrial labor cost developed country
12	13	This could turn into an opportunity for emerging markets to offer competitively priced services based on differences in the wages of skilled workers across countries, offering new opportunities for imagining a new future economic	Developed country service GDP -> Average service wage developed country -> Service labor cost developed country -> Trade in services -> Change in

		development model, one that also entails higher investment in human capital	developed country service GDP -> Developed country service GDP Developing country service GDP -> Average service wage developing country -> Service labor cost developing country -> Trade in services -> Change in developing country service GDP -> Developing country service GDP
13	13	Recent experience suggests that companies that have consistently applied the principles of stakeholder capitalism during the crisis – paying attention to the well-being of their employees, suppliers and customers to the same degree as considering the immediate interests of their shareholders – have weathered the crisis better than others.	Extent to which a company follows ESG standards -> Resilience -> Change in capital
14	14	Yet, the implementation of ESG standards, which stretches from the implementation of diversity, equity and inclusion strategies to reduction in carbon emissions, is costly in the short-run.	Capital -> Extent to which a company follows ESG standards -> Change in capital -> Capital

Table 1. Causal links found within World Economic Forum (2020)

Reference

World Economic Forum (2020) *Emerging pathways towards a post-COVID-19 reset and recovery*.
http://www3.weforum.org/docs/WEF_Emerging_Pathways_towards_a_Post-COVID-19_Reset_and_Recovery_2020_final.pdf, accessed on 21 October 2020.