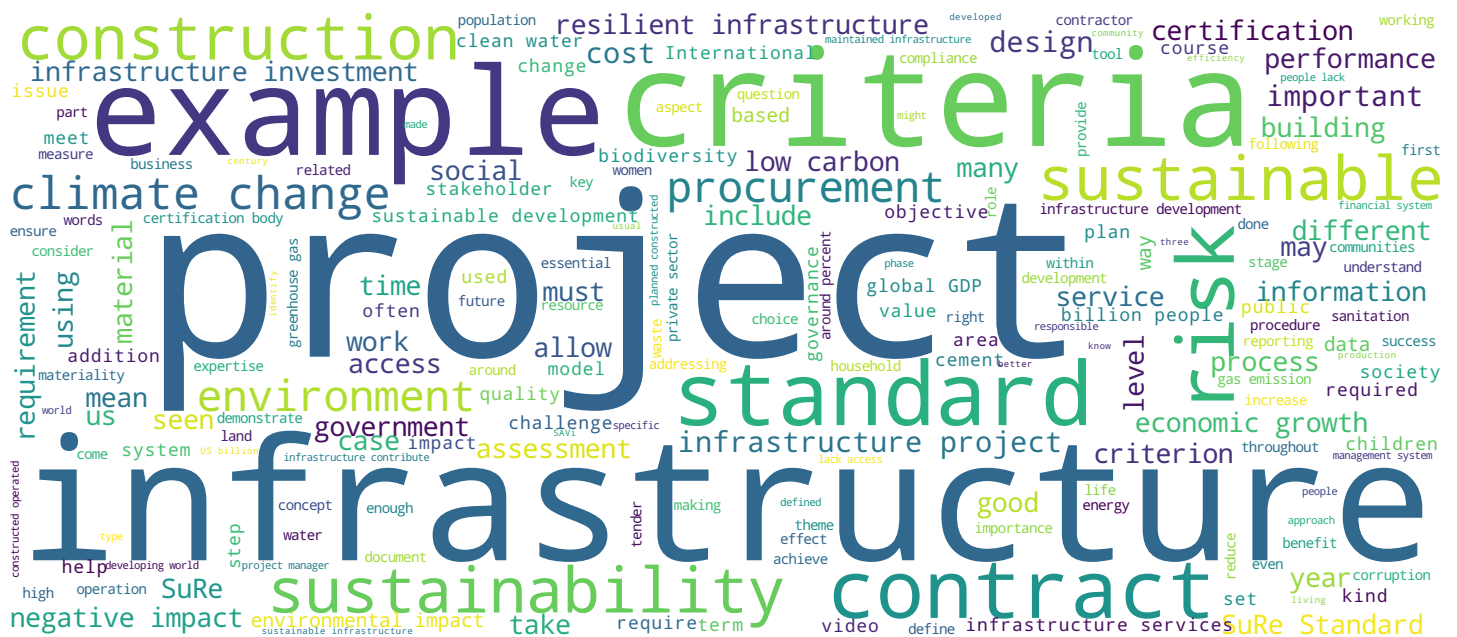


## Prof. Dr. Bruno Oberle &amp; Dr. Katharina-Maria Rehfeld





- Infrastructure and sustainable development
- Costs of infrastructure
- Positive and negative impacts of infrastructure
- Sustainable and resilient infrastructure

In this video lecture, we are going to introduce key terminologies and concepts we will refer to throughout this course. We will define what infrastructure and sustainable development is. We will talk about the costs of infrastructure and the future investment needs. We will then discuss positive and negative impacts of infrastructure and finally define what we understand by sustainable and resilient infrastructure.

Notes

Summary



0m 05s

**Infrastructure** = sum of all physical assets, equipment and facilities or the basic facilities, services, and installations needed for the functioning of a community or society.

Infrastructure can be seen as the sum of all physical assets, equipment and facilities. or in other words, the basic facilities, services, and installations needed for the functioning of a community or society.

Notes

Summary



0m 34s

A functioning and resilient infrastructure is the foundation of every successful community.

In economic terms, infrastructure can be seen as structures that allow or that allow to simplify the production and exchange of goods and services. Infrastructure can be seen as the basic requirement for a proper functioning economy. A functioning and resilient infrastructure is the foundation of every successful community.

Notes

Summary



0m 55s

A functioning and resilient infrastructure is the foundation of every successful community.



Roads, ports, airports, rails, and telecom networks are the conduits of trade and mobility. Electricity fuels production, and clean water underpins public health. Investment that modernizes and maintains these systems can propel economic growth.

Notes

Summary



1m 22s



- Basic sanitation: 2.4 bn
- Clean water: 2.4 bn people
- Constant electricity in the developing world: 2.6 bn people
- Internet: 4 bn people



Not everywhere on the planet infrastructure endowment is sufficient. Let us give you some data to demonstrate this. Worldwide, 2.4 billion people lack access to basic sanitation, and almost 800 million people lack access to clean water. 2.6 billion people in developing countries do not have access to constant electricity. More than 4 billion people still do not have access to the Internet; 90 percent of them are in the developing world.

Notes

Summary



1m 45s



Because infrastructure is a critical enabler of both direct and indirect societal benefits, infrastructure is a core element of the UN Sustainable Development Goals. These include: - Ensuring the availability and sustainable management of water and sanitation for all. - Ensuring access to affordable, reliable, sustainable, and modern energy for all. - Building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation.

Notes

Summary



2m 23s





- Infrastructure: Driver of economic growth and development
- Socio-economic rate of 20:1

By 2030, states shall upgrade infrastructure to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities. Investment in infrastructure and innovation are also crucial drivers of economic growth and development. With over half the world population now living in cities, mass transport and renewable energy are becoming ever more important, as are information and communication facilities, water supply and sewage and waste management system. Infrastructure typically has a socioeconomic rate of return of around 20 percent. In other words, one dollar of infrastructure investment can raise GDP by 20 cents in the long run. These economic effects stem mostly from making a given region more productive through means such as reduced travel time and costs, access to reliable electricity, and broadband connectivity that allows individuals and businesses to plug into the digital global economy.

Notes

Summary



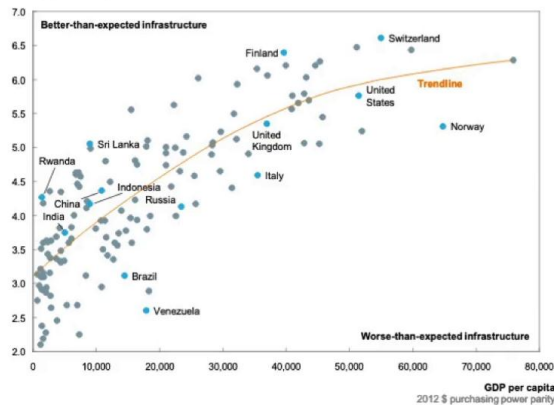
3m 00s



Assessing each country's infrastructure quality against GDP per capita gives an indicator of its progress

Infrastructure quality vs. GDP per capita for selected countries

World Economic Forum (WEF) infrastructure quality index (higher is better)



SOURCE: World Economic Forum; World Bank; McKinsey Global Institute analysis

McKinsey (2016): Bridging global infrastructure gaps

<https://www.un.org/pga/71/wp-content/uploads/sites/40/2017/06/Bridging-Global-Infrastructure-Gaps-Full-report-June-2016.pdf>

- Infrastructure: Driver of economic growth and development
- Socio-economic rate of 20:1
- Positive correlation between infrastructure quality and GDP/capita

Some infrastructure investments, if well-chosen and well executed, can have benefit-cost ratios of up to 20:1 This graph shows you for example the positive correlation between infrastructure quality and GDP per capita.

Notes

Summary





- Challenge of advanced economies: upgrading and modernizing



- Challenge of developing economies: meeting basic needs

Advanced economies face the challenge of maintaining extensive transport, power, water, and telecommunications networks and upgrading and modernizing them as growth flags. In the developing world, countries dedicate a large proportion of their national income just to meet basic human development needs—access to water and sanitation, electricity, and all-weather roads, for instance - and still cannot cater to large parts of their populations. The challenge in these countries is becoming even more daunting as rapid growth fuels demand for infrastructure to support economic and social development.

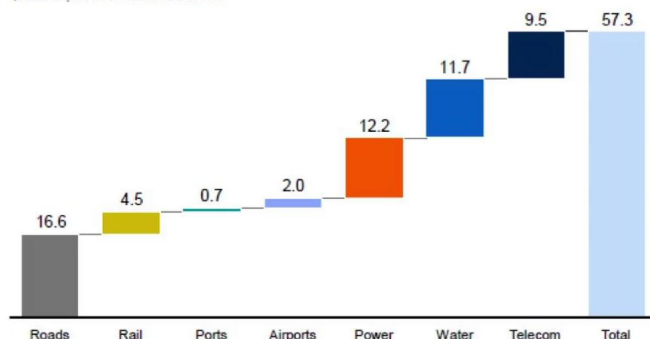
Notes

Summary



4m 46s

Based on projections of demand by infrastructure segment, about \$57 trillion, or 3.5 percent of global GDP, is needed through 2030  
Global investment, 2013–30  
\$ trillion, constant 2010 dollars



1 OECD telecom estimate covers only OECD members plus Brazil, China, and India.  
NOTE: Figures may not sum due to rounding.  
SOURCE: OECD; IHS Global Insight; GWI; IEA; McKinsey Global Institute analysis

McKinsey (2013): Infrastructure productivity: How to save \$1 trillion a year  
[https://www.mckinsey.com/~media/mckinsey/industries/capital%20projects%20and%20infrastructure/our%20insights/infrastructure%20productivity/mgi%20infrastructure\\_executive%20summary\\_jan%202013.ashx](https://www.mckinsey.com/~media/mckinsey/industries/capital%20projects%20and%20infrastructure/our%20insights/infrastructure%20productivity/mgi%20infrastructure_executive%20summary_jan%202013.ashx)

- Global infrastructure investment need to increase by nearly 60 % to \$57 trillion over the next 18 years (McKinsey 2013).

Simply to support projected economic growth between now and 2030, McKinsey estimated in 2013 that global infrastructure investment would need to increase by nearly 60 percent from the \$36 trillion spent on infrastructure over the past 18 years to \$57 trillion over the next 18 years. This baseline estimated investment requirement, which is equivalent to 3.5 percent of anticipated global GDP, would be enough to support anticipated growth, maintaining current levels of infrastructure capacity and service relative to GDP.

Notes

Summary



5m 33s

A balanced scorecard shows the G20's infrastructure gaps

Countries	Investment trajectory			Infrastructure quality and access gaps		
	Infrastructure investment gap Need 2016-30 vs. actual 2008-13, percentage points of GDP	Post-crisis investment increase Percentage points of GDP 2008-13 vs. 2000-07	Post-crisis public investment increase Percentage points of GDP 2010-14 vs. 2004-08	Infrastructure quality gap Points in WEF ranking, actual vs. income- expected	Share of households without access to electricity %	Share of individuals without Internet access %
Argentina	n/a	n/a	n/a	n/a	4.0	35.3
Australia	-1.2	1.0	0.3	-0.6	0	15.4
Brazil	0.7	0.3	n/a	-1.1	0	42.4
Canada	0	0.3	0.5	0	0	12.8
China	-3.3	0.3	0.3 <sup>2</sup>	0.4	0	50.7
France	-0.1	0	0	0.6	0	16.3
Germany	0.4	0	0.3	0.3	0	13.8
India	0.5	0.6	n/a	0.3	25.0	82.0
Indonesia	1.3	0.4	n/a	0.4	24.6	82.8
Italy	-0.1	-0.6	-0.4	-0.8	0	38.0
Japan	-1.5	-0.7	-0.1	0.8	0	9.4
Mexico	1.1	0	0.8 <sup>2</sup>	-0.1	5.0	55.6
Russia	0.1	0.1	-1.0	-0.6	11.9	29.5
Saudi Arabia	0.0	-1.6	n/a	-0.7	1.0	36.3
South Africa	1.2	1.2	n/a	0.5	15.0	51.0
South Korea	n/a	n/a	-0.4 <sup>2</sup>	0.3	5.0	15.7
Turkey	0.6	0.5	n/a	0.7	5.0	48.0
United Kingdom	0.4	-0.1	0.4	-0.1	0	8.4
United States	0.7	0	-0.2	-0.2	0	12.6

<sup>1</sup> Argentina's data cover only power, water, and telecom.

<sup>2</sup> 2013 rather than 2014 data.

SOURCE: IHS Global Insight; ITF; GWP; National Statistics; World Economic Forum; World Bank; McKinsey Global Institute analysis

McKinsey (2016): Bridging global infrastructure gaps

<https://www.un.org/pga/71/wp-content/uploads/sites/40/2017/06/Bridging-Global-Infrastructure-Gaps-Full-report-June-2016.pdf>

- Current investment rates will not meet future infrastructure needs.

It does not account for the cost of addressing the large maintenance and renewal backlogs and infrastructure deficiencies in many economies. Nor would it raise the standard of infrastructure in emerging economies beyond what we would expect as part of a normal development trajectory. The projection also does not consider the costs of making infrastructure more resilient to the effects of climate change or the higher cost of building infrastructure in ways that have less impact on the climate and the environment. If current investment rates remain unchanged, the world will fall far short of these projected needs. Baseline needs already exceed investment by around 0.4 percent of global GDP, or \$350 billion annually. In cumulative terms, the gap totals \$5.2 trillion globally across the entire period from 2016 to 2030. Many of the world's largest economies, emerging and developed alike, are on trajectories that will produce notable shortfalls. As you can see in this table this applies to developing and developed countries alike.

Notes

Summary





- Infrastructure can contribute to higher quality of life and reduced inequality.
- Yet, the right choice of infrastructure is crucial.
- Not considering environmental impacts can lead to unintended costs and drawbacks.

In addition to economic growth, physical and economic accessibility to infrastructure contribute to higher quality of life and reduce the level of inequality and poverty. For example: - The consumption of infrastructure services, such as clean water and sanitation, are essential for human health and the creation of economic welfare. - Infrastructure services such as energy, transportation, schools or telecommunications provide increased job availability, improved education and the possibility to have access to goods and services. - Improved accessibility and thus a reduced cost for infrastructure services to households can have beneficial effects such as increasing a household's real income and consumption, raising labour productivity and also freeing up time for individuals. Depending on the choice of infrastructure and how it is planned, constructed, operated and maintained, infrastructure can have positive or negative impacts on our environment, in addition to its effects on society and the economy. Due to its long lifespan, infrastructure results in lasting impacts during operation and beyond.

Notes

Summary



7m 45s

# Positive and negative Impacts of Infrastructure **EPFL**



For example, infrastructure such as waste recycling facilities or sewage treatment plants has positive impacts due to its vital contribution to waste and pollution reduction.

Notes

Summary



9m 10s





- Sustainability issues
- Destruction and degradation of natural habitats
- Loss of biodiversity
- Poaching
- Illegal mining
- Wildfires and land speculation
- Threatened health and safety

However, infrastructure also often leads to devastating impacts on our environment, for example: - Inadequate infrastructure may cause sustainability issues: destruction and degradation of natural habitats, loss of biodiversity, poaching, illegal mining, wildfires and land speculations, as well as threatened health and safety of both employees and affected society.

Notes

Summary







- Infrastructure can increase pollution such as noise, air, soil and water pollution. For example, emissions from coal-fired powerplants in China were responsible for a quarter of a million premature deaths in 2011 due to air pollution, and are damaging the health of hundreds of thousands. - Infrastructure related to the exploitation of natural resources, such as hydroelectric dams, mines and oil platforms cause major disruptions to ecosystems, causing intensive local environmental impacts. Furthermore, such invasive infrastructure projects provide major impetus for additional infrastructure developments (such as additional roads and power line networks), which have often worse environmental impacts than the original project. - Therefore, projects that do not consider their environmental impact produce massive unintended costs and drawbacks for both project operators and society. Furthermore, such projects will have negative consequences over the entire life span. Depending on the choice of infrastructure and how it is planned, constructed, operated and maintained, infrastructure can have lasting positive or negative impacts on environment, society and the economy.

Notes

Summary



9m 51s



The way forward is to implement sustainability and resilience criteria into infrastructure development and, therefore, to maximize the positive effects on productivity and quality of life while minimizing the negative impacts on the environment.

Notes

Summary



11m 21s



- Rethinking Infrastructure (OECD 2018)
  - Energy, transport, buildings and water infrastructure contribute over 60% of greenhouse gas emissions.
  - Low-carbon infrastructure combined with structural reforms can increase global GDP by as much as 5% by 2050 and cutting emissions.

<http://www.oecd.org/environment/financing-climate-futures-9789264308114-en.htm>

The OECD, UN Environment and World Bank Group delivered to the G20 at its Summit in Buenos Aires in November 2018 a new report, Financing Climate Futures: Rethinking Infrastructure. The three International Organisations ask governments to adopt a more transformative agenda on low-carbon, climate-resilient investments if they are to meet the Paris Agreement goal of cutting CO2 emissions to net zero in the second half of the century and build resilience to climate change. The infrastructure that is built today must be ready to cope with tomorrow's changing climate. Investing in low-carbon, low-emission and sustainable infrastructure is critical to increase resilience and avoid further carbon lock-in and it can also drive economic growth. The infrastructure challenge creates incentives for reforms that can deliver better performance on both counts. Noting that energy, transport, buildings and water infrastructure contribute over 60% of greenhouse gas emissions, the report lays out six ways to bring public and private financial flows in line with the Paris goals. Shifting infrastructure investment into low-carbon options, combined with structural reforms, could increase global GDP by as much as 5% by 2050, while cutting emissions.

Notes

Summary



11m 39s



- Design of a Sustainable Financial System (UNEP Inquiry 2018)
  - Sustainability is becoming part of routine practice within financial institutions and regulatory bodies.
  - Green bond issuance grew from US\$11 billion in 2013 to US\$155 billion in 2017.

[https://wedocs.unep.org/bitstream/handle/20.500.11822/20715/Roadmap\\_for\\_a\\_Sustainable\\_Financial\\_System\\_Summary.pdf?sequence=1&isAllowed=y](https://wedocs.unep.org/bitstream/handle/20.500.11822/20715/Roadmap_for_a_Sustainable_Financial_System_Summary.pdf?sequence=1&isAllowed=y)

The final report of the UN Environment Inquiry into the Design of a Sustainable Financial System, released in April, found that progress on reforming the global financial system over the last four years has started to deliver financing for sustainability and set up the next wave of action. Sustainability is becoming part of routine practice within financial institutions and regulatory bodies, green bond issuance grew from US\$11 billion in 2013 to US\$155 billion in 2017.

Notes

Summary



13m 15s



- Much still needs to be done.
- Expertise is needed at the side of governments, financiers and developers.
- Especially project management skills are critical.

However, much more needs to be done, particularly in infrastructure. With only 12 years to head off the worst impacts of climate change, we need rapid reform of our economies and societies, including a switch to low-carbon infrastructure. Governments and other infrastructure owners need expertise in these new fields, and most of them do not have enough of it. Some are addressing this issue by building central training centers, rotation programs, or academies to develop critical skills. Others are partnering with or building external entities to attract private-sector talent, as in the case of Infrastructure Ontario. On the delivery side, the skills of the project manager make the difference. Research across thousands of projects indicates that top project managers consistently deliver projects in top quality, ahead of time and below cost.

Notes

Summary



13m 54s





Building project management capabilities takes time but is a key to success. This course aims at helping you building this expertise and we do hope you find it useful.

Notes

Summary



15m 00s