



VILNIUS GEDIMINAS  
TECHNICAL UNIVERSITY  
FACULTY OF CIVIL ENGINEERING

# TECHNOLOGY FORESIGHT AND SCENARIO PLANNING IN ENGINEERING

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## **PART V**

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- ✓ **Description and Explanation of Selected Foresight Methods: Extended SWOT Analysis**
- ✓ **Scenario Planning**
- ✓ **Foresight in Construction Industry**



# SWOT Analysis

**SWOT** was developed by Kenneth Andrews in the early 1970s as an instrument of strategic management for companies.

**SWOT** analysis is an analytical method which is used to identify and categorise significant internal and external factors faced either in a particular arena, such as an organisation, or a territory, such as a region, nation, or city.

The **SWOT** analysis provides information that is helpful in matching the organisation's resources and capabilities to the competitive environment in which it operates. As such, it is instrumental in strategy formulation and selection.

Since then it has developed into many different versions and has been applied in many different fields (including foresight).

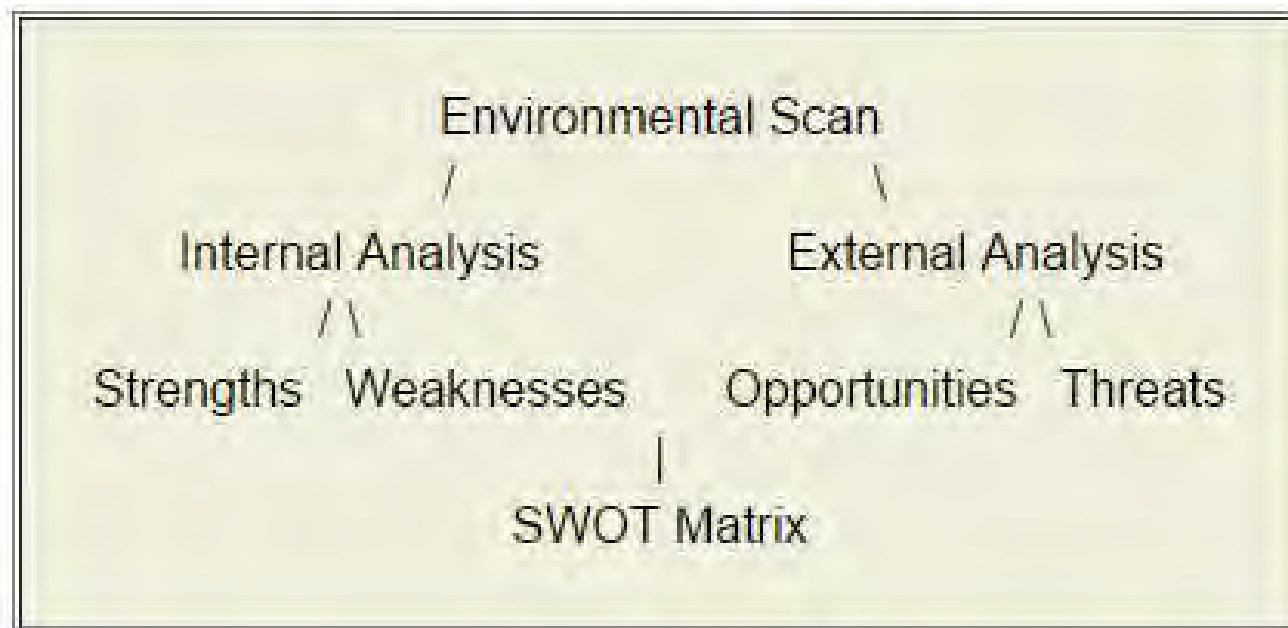
**SWOT** analysis can be a good starting point for the discussions in Foresight.



# SWOT Analysis

SWOT analysis is derived from environmental scan.  
An environmental scan is an objective review of the current and anticipated environmental factors that impact a given organization.

## SWOT Analysis Framework



<http://www.quickmba.com/strategy/swot/>



# SWOT Analysis

The essence of the classical SWOT analysis is to identify:  
**STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS**  
of a given object (company, organisation, region, process)



[http://en.wikipedia.org/wiki/Strategic\\_management](http://en.wikipedia.org/wiki/Strategic_management)

**Strengths** (internal, positive factors)

**Weaknesses** (internal, negative factors)

**Opportunities** (external, positive factors)

**Threats** (external, negative factors)



# Extended SWOT Analysis

- **Existing factors** – factors that exist at the moment of the study and currently influencing the analysed system
- **Potential factors** – factors that may have a positive or negative influence on the system in future
- **Factors originating from the inside of the system (internal)** – factors that characterise the activity and resources of the system
- **Factors from the environment (external)** – factors originating from the outside of the system but influencing it
- **Favourable (positive) factors** – factors positively influencing the system, originating either from inside or from outside of the system
- **Unfavourable (negative) factors** – factors negatively influencing the system, originating either from inside or from outside of the system



# Extended SWOT Analysis

		Inside the system	Outside the system				
Existing factors	Positive	Strengths	Stimulants				
	Negative	Weaknesses	De-stimulants				
		Inside the system	Outside the system				
		Internal opportunities	External opportunities	Positive	Potential factors		
		Internal threats	External threats	Negative			



# Exercise – SWOT Analysis

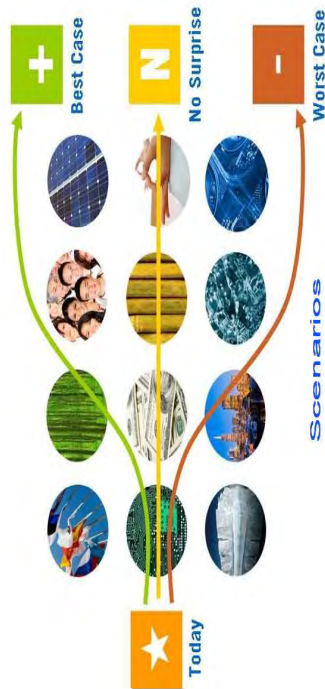
*For Civil Engineering Education  
in Lithuania determine:*

- ***Strengths***
- ***Weaknesses***
- ***Stimulants***
- ***De-stimulants***
- ***Internal opportunities***
- ***External opportunities***
- ***Internal threats***
- ***External threats***





# Scenario method



**Scenario method** is a procedure of a logical and coherent description of a chain of events in order to illustrate how the current state evolves into the future state.

**Scenario** is a description of interrelations between factors that determine the development of a given situation in a given time.

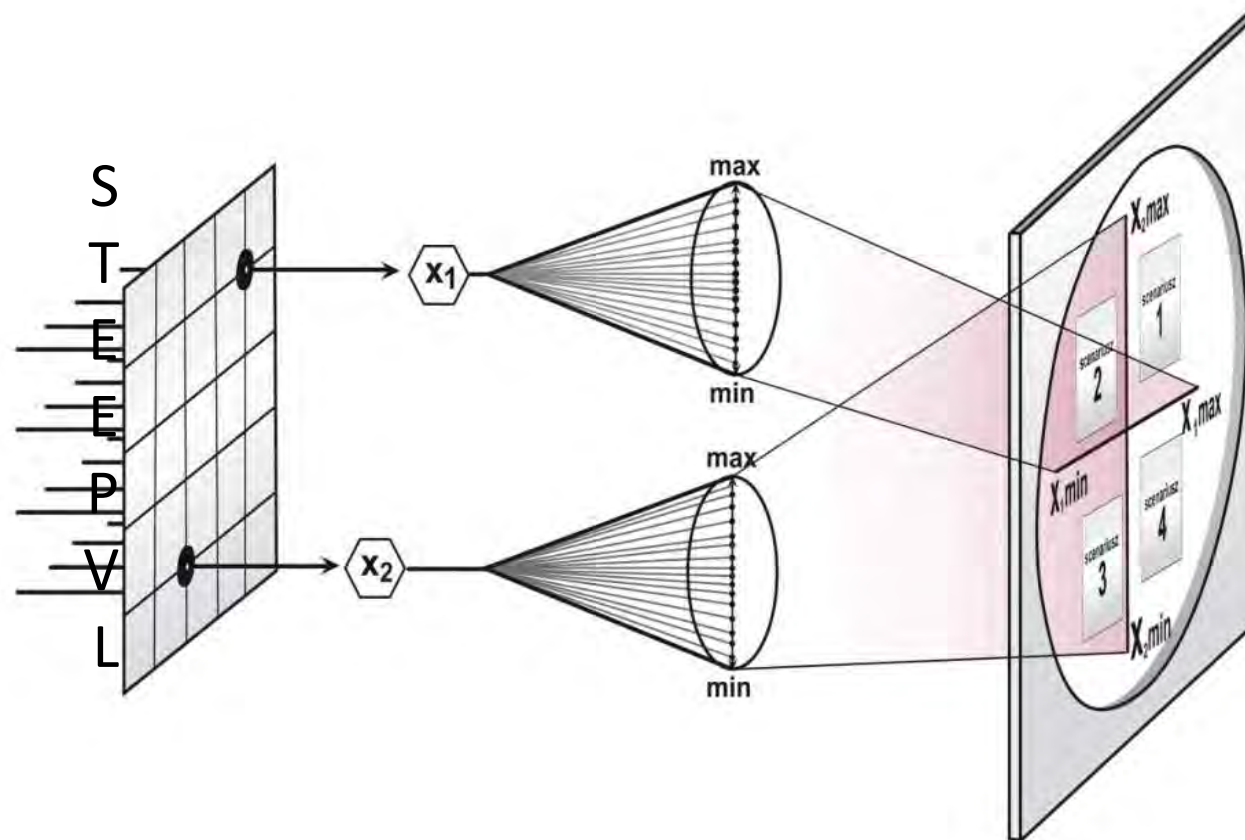
[A. H. Jasiński]

**Scenarios** are systematic visions of opportunities that the future may bring.

[I. Miles]



# The concept of scenario construction

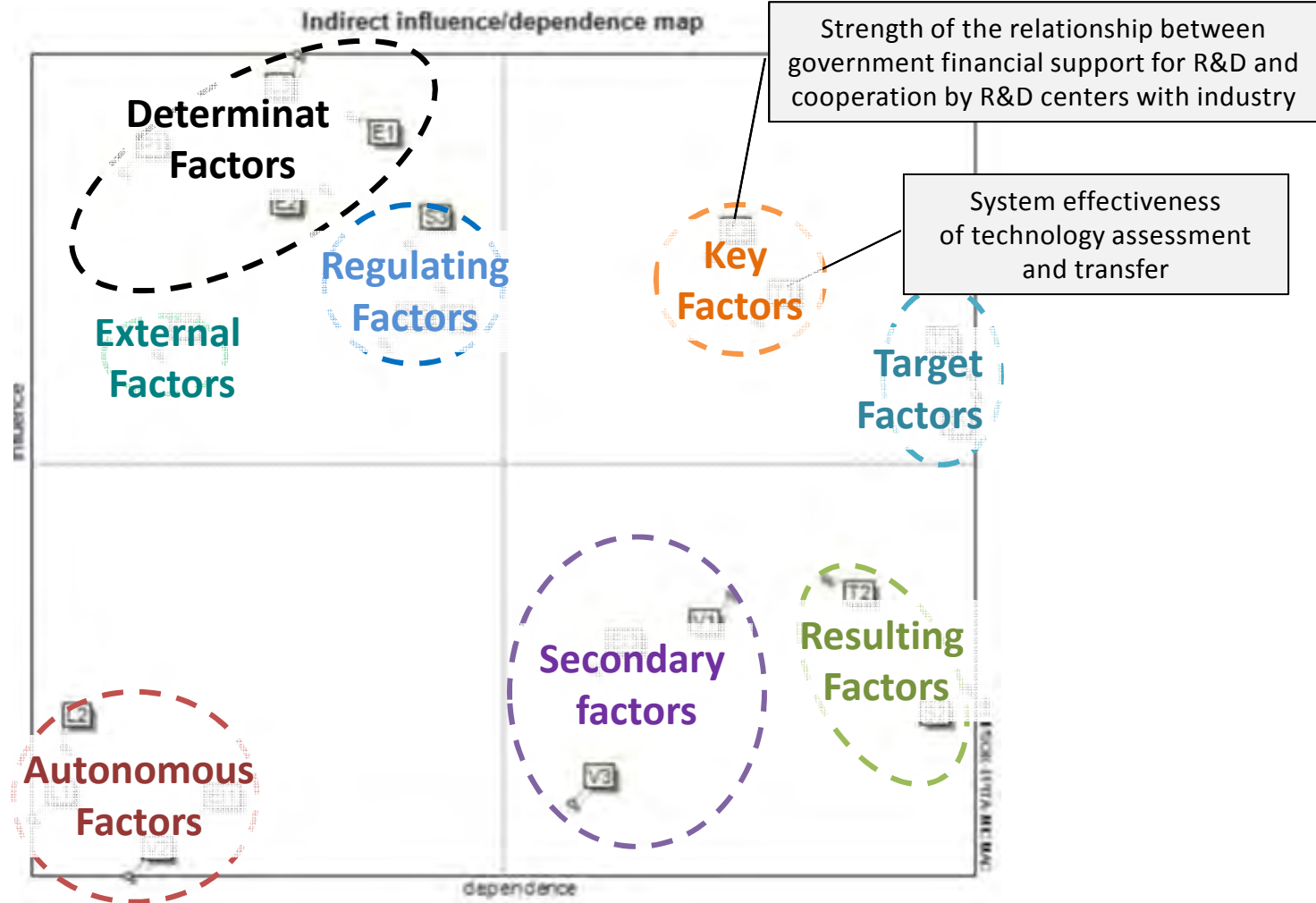


Source: A . Kononiuk, *Metoda scenariuszowa w antycypowaniu przyszłości (na przykładzie Narodowego Programu Foresight „Polska 2020”)*, rozprawa doktorska, Wydział Zarządzania Uniwersytetu Warszawskiego, Warszawa 2010 (niepublikowana)



# Influence/Dependence Map of STEEPVL Factors

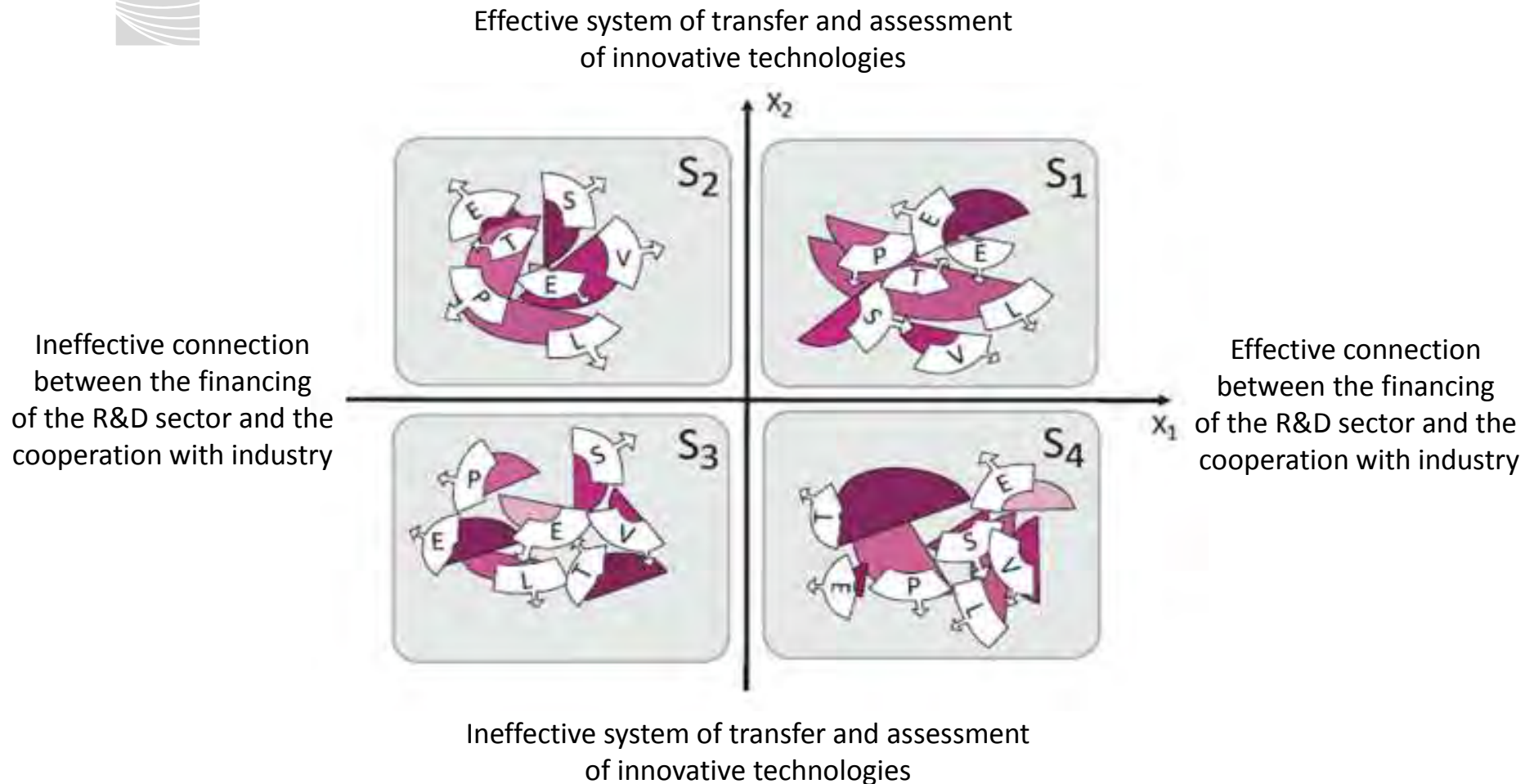
## Innovation-Oriented Development of Mazovian Enterprises





# Scenario building concept

## Innovation-Oriented Development of Mazovian Enterprises

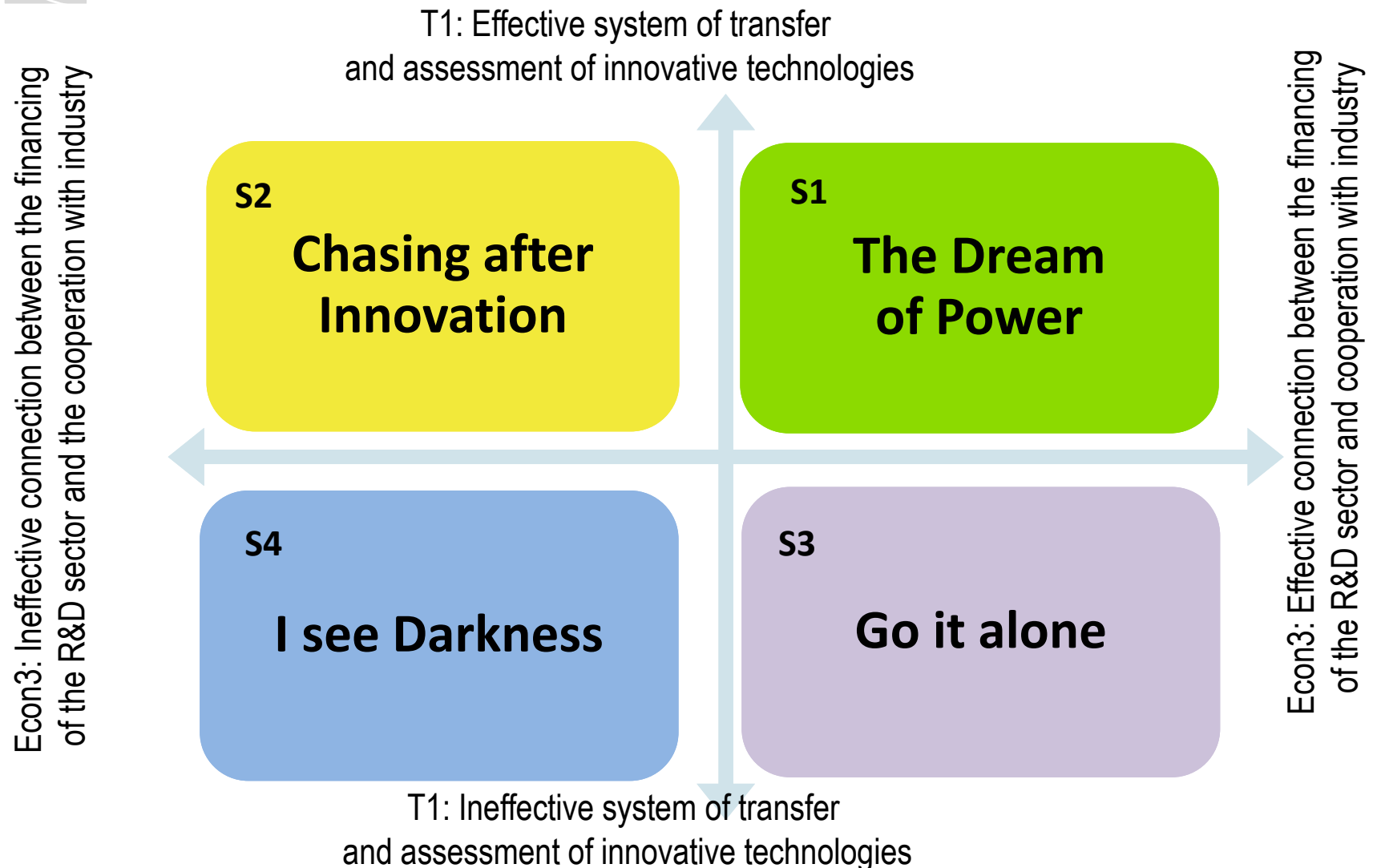


### Possible scenario options for the innovation-oriented development of Mazovian enterprises

Source: Author's own elaboration based on: Nazarko J. (red.), Wnorowski H. (red.), Kononiuk A. (red.), *Analiza strukturalna czynników rozwoju nanotechnologii w województwie podlaskim*. Oficyna Wydawnicza Politechniki Białostockiej, Białystok 2011.

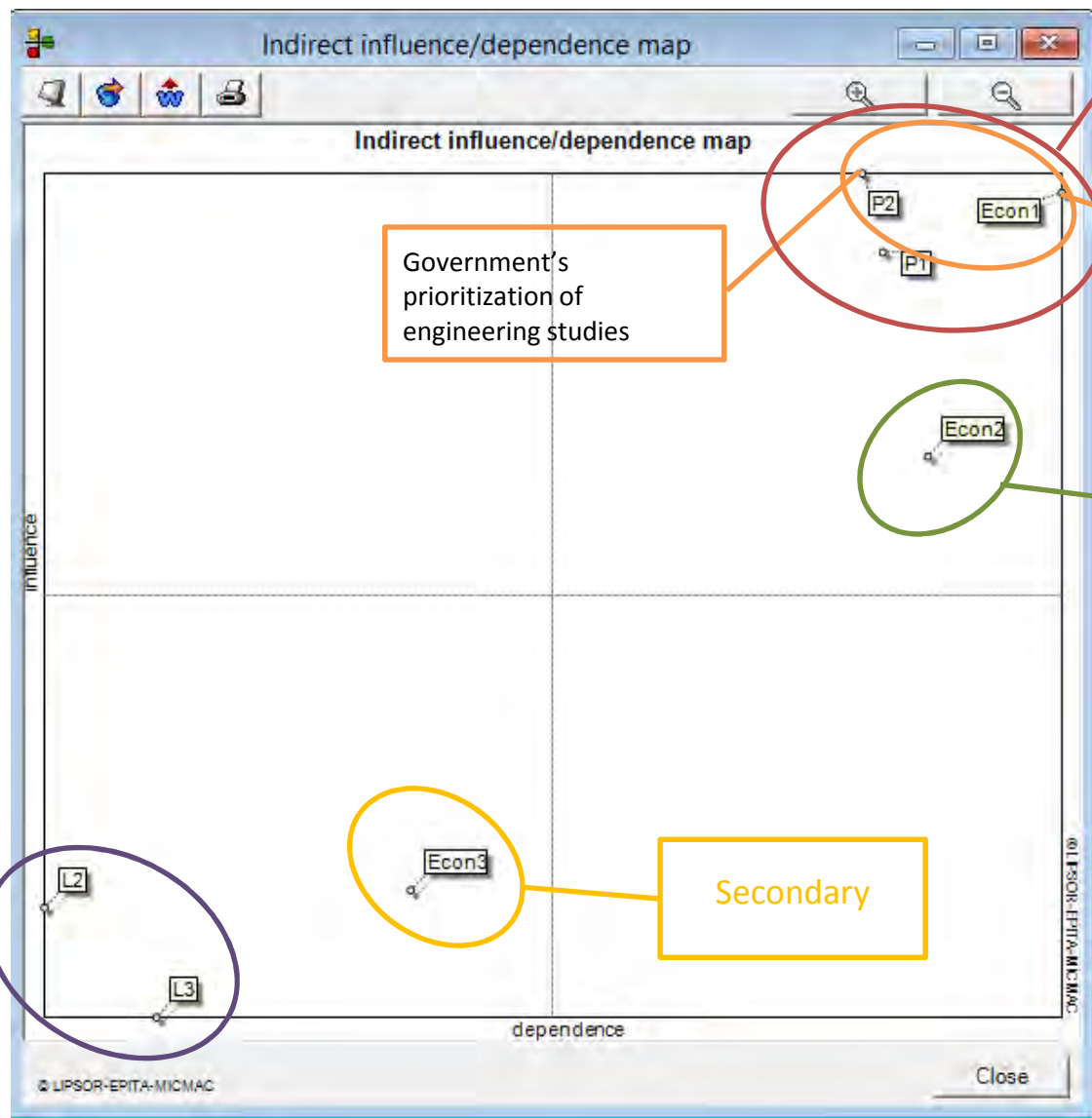


# Scenarios of the Innovation-Oriented Development of Mazovian Enterprises





# Indirect Influence/Dependence Map



Key (stake)

Government spending on Civil Engineering education

Government's prioritization of engineering studies

Target

Autonomous

Secondary



# Scenario building concept

## The Future of Civil Engineering Education in Lithuania

### Key Factors:

Ekon1: Government's prioritization of engineering studies

P2: Government spending on Civil Engineering education

<http://www.redhawkenergy.net/factors.html>



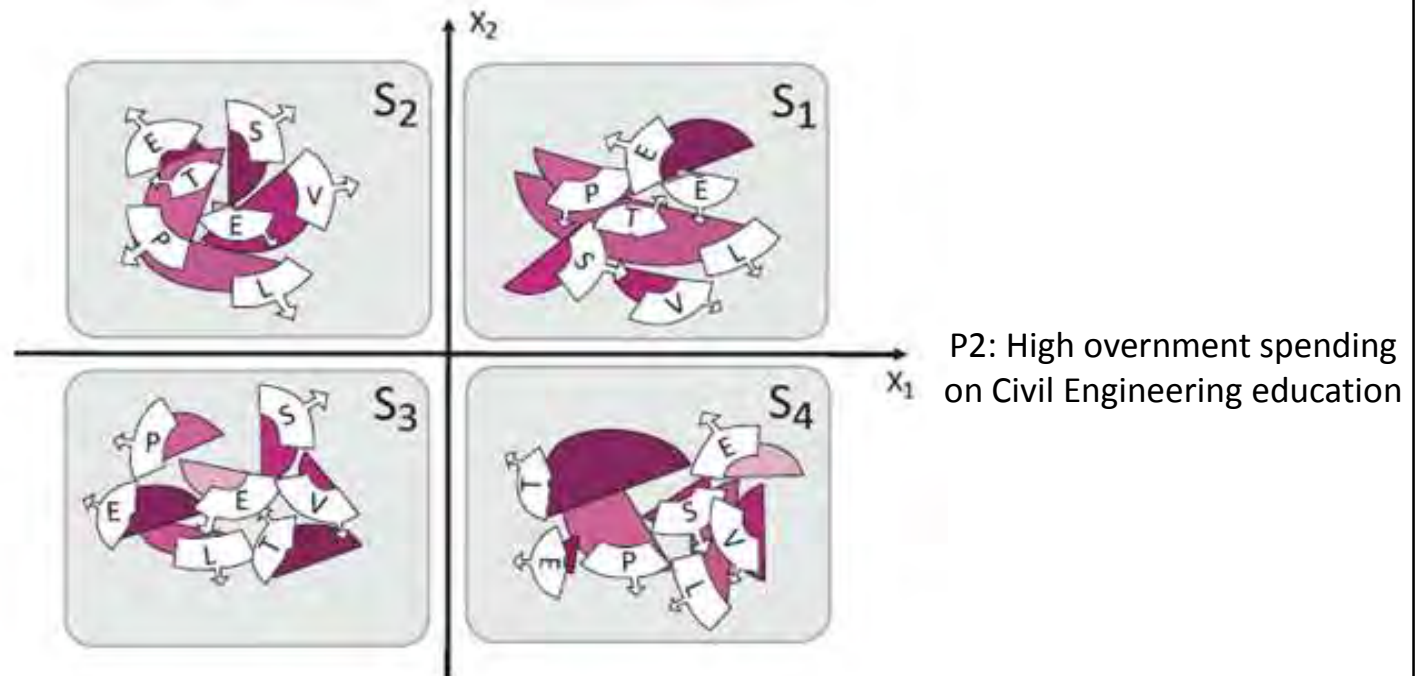


# Scenario building concept

## The Future of Civil Engineering Education in Lithuania

Ekon1: High government's prioritization  
of engineering studies

P2: Low government spending  
on Civil Engineering education



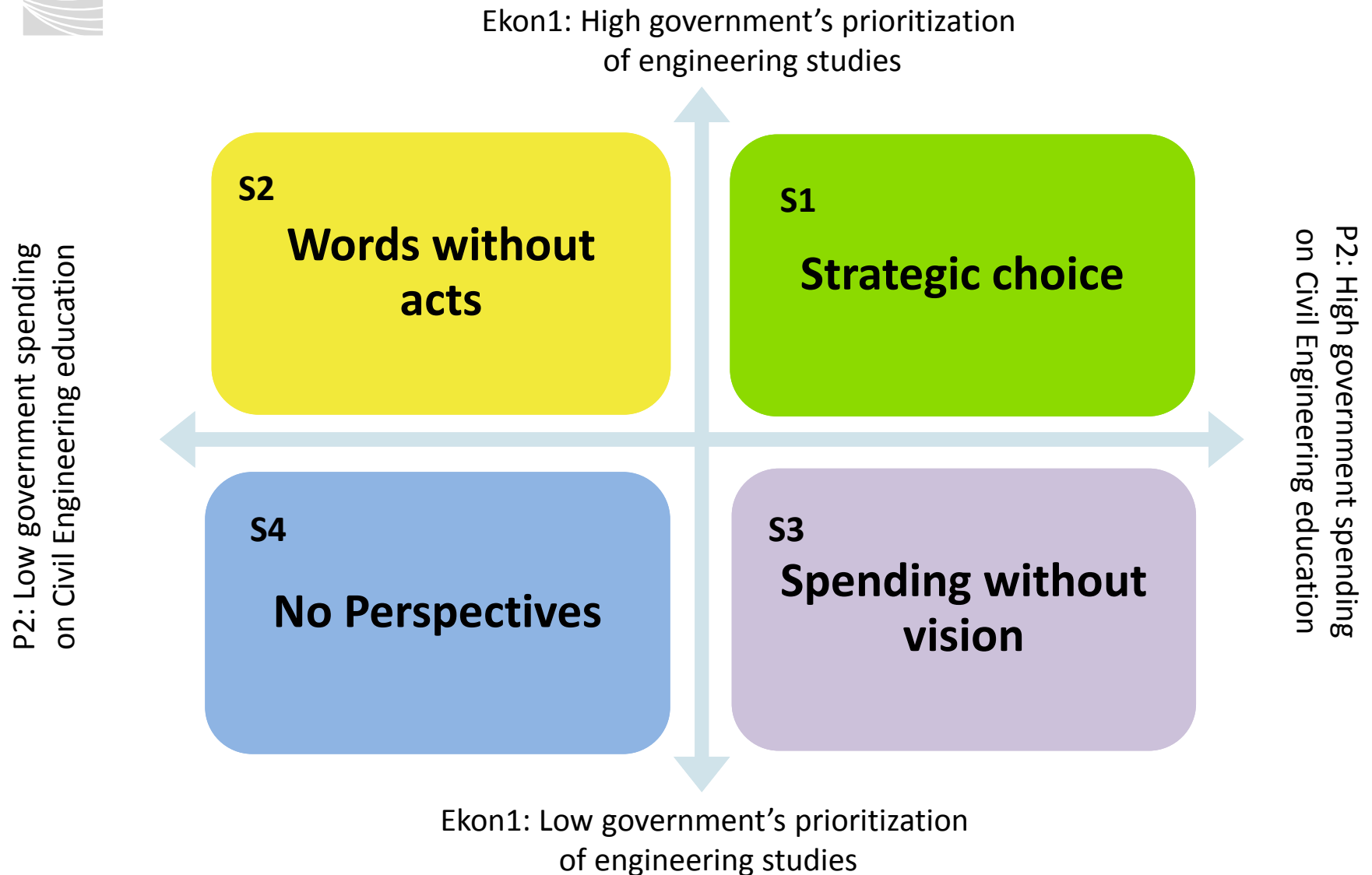
Ekon1: Low government's prioritization  
of engineering studies

**Possible scenario options for the Future of Civil Engineering Education in Lithuania**





# Possible scenario options for the Future of Civil Engineering Education in Lithuania





# Overview of Construction Future Studies

**C2020 Vision. The Future of the Australian Construction Industry**



**Built Environment Foresight 2030:**

the sustainable development imperative



**Perspectives of the road surface technologies development in the context of sustainable development**

**Construction IT In 2030: A Scenario Planning Approach**



**Technology Foresight Ireland - Construction and Infrastructure Panel**



# Overview of Construction Future Studies

## Specific issues identified in the construction future studies (1/3)

<b>Technological</b>	<ul style="list-style-type: none"><li>Increased standardisation and offsite construction</li><li>Increased use of common ICT and information sharing platforms</li><li>Increased automation and use of robotics</li><li>Increased use of 3D technology (virtual reality, CAD)</li><li>New / smart construction materials</li></ul>
<b>Environmental</b>	<ul style="list-style-type: none"><li>Increased importance of sustainability</li><li>Climate change / global warming / extreme weather</li><li>Resources / energy conservation</li><li>Oil depletion / energy crisis</li><li>Reduce waste and pollution / increased recycling</li><li>Increased urbanisation</li><li>Demographics changes</li></ul>

Source: Harty, C., Goodier, C.I. Soetanto, R., Austin, S.A., Dainty, A.R.J., Price, A.D.F., *The Futures of Construction: A critical review of construction future studies*, Loughborough University, 2007



# Overview of Construction Future Studies

## Specific issues identified in the construction future studies (2/3)

### Human

Reduction of skilled trades / consolidation of professions  
Shift education and training requirements  
Improved health and safety, welfare and working conditions  
Flexible working  
Smaller households  
Changing healthcare needs and requirements  
Vulnerability and security

### Economic

More profitable, efficient and competitive construction industry  
Increased foreign competition and globalisation  
Consolidation and de-fragmentation of construction industry  
Increased use of whole-life costing, PPP and PFI initiatives  
Increase gap between rich and poor

Source: Harty, C., Goodier, C.I. Soetanto, R., Austin, S.A., Dainty, A.R.J., Price, A.D.F., *The Futures of Construction: A critical review of construction future studies*, Loughborough University, 2007



# Overview of Construction Future Studies

## Specific issues identified in the construction future studies (3/3)

<b>Governance</b>	Changes in government policy Increased or alignment of legislation and regulation
<b>Other</b>	Wild cards Major shocks

Source: Harty, C., Goodier, C.I. Soetanto, R., Austin, S.A., Dainty, A.R.J., Price, A.D.F., *The Futures of Construction: A critical review of construction future studies*, Loughborough University, 2007



# Overview of Construction Future Studies

## Two Scenarios (1/3)

Nature of Change	Scenario 1	Scenario 2
<b>Increased legislation and regulation</b>	<p>Opens up international / global markets for UK firms by providing common standards</p> <p>New competencies of construction professionals in ensuring compliance</p>	<p>UK market opened up to foreign competitors</p> <p>Professionals become legislators rather than creative workers</p>
<b>Whole life cycle approach</b>	<p>Reintegration and consolidation of fragmented industry</p> <p>Consistent levels of work and income</p>	<p>Only a few large firms survive; SME's all but gone</p> <p>Construction becomes a loss leader for FM and service provision</p>

Source: Harty, C., Goodier, C.I. Soetanto, R., Austin, S.A., Dainty, A.R.J., Price, A.D.F., *The Futures of Construction: A critical review of construction future studies*, Loughborough University, 2007



# Overview of Construction Future Studies

## Two Scenarios (2/3)

### Education in construction

The same building is constructed again and again

Traditional skills based on-site are lost

Construction work is colonised by manufacturing firms, both from UK and abroad

Construction seen as an objective and IT driven process, at expense of creativity and inspiration

Professions as they stand are lost, replaced by 'jack of all trades'

### Technology 1: Shift to more standardisation and off-site construction

The industry rhetoric comes true

Economies of scale can be generated

Standardised components reduce risk in construction

The same building is constructed again and again

Traditional skills based on-site are lost

Construction work is colonised by manufacturing firms, both from UK and abroad

Source: Harty, C., Goodier, C.I. Soetanto, R., Austin, S.A., Dainty, A.R.J., Price, A.D.F., *The Futures of Construction: A critical review of construction future studies*, Loughborough University, 2007



# Overview of Construction Future Studies

## Two Scenarios (3/3)

### Technology 2: Use of common Information Sharing platforms

Construction process much more transparent and errors and delays resulting from communication problems eliminated

Clients take a proactive role in design

Competitive edge and distinctiveness / individuality of firms and professionals lost

Design becomes the reproduction of client expectations and internal innovation is stultified

### Technology 3: Automation and robotics

Health and safety greatly improved by use of robots in potentially hazardous environments

Higher accuracy and standards of work achieved

Tradesmen are replaced by robots and traditional skills are lost

Source: Harty, C., Goodier, C.I. Soetanto, R., Austin, S.A., Dainty, A.R.J., Price, A.D.F., *The Futures of Construction: A critical review of construction future studies*, Loughborough University, 2007





**Thank you for your attention!**

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