Solar Cooling Integrated Façades

Towards investigating product applicability

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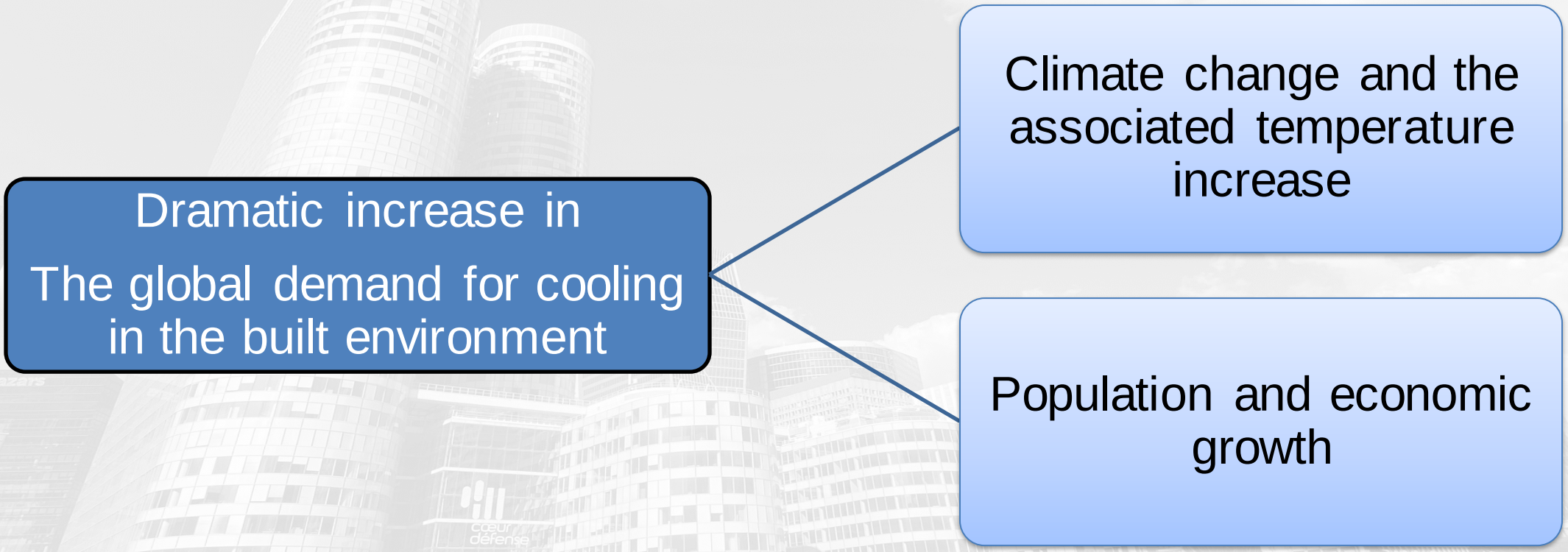
Presentation Outline

- **Introduction**
- **Materials and Methods**
- **A Conceptual Approach**
- **Conclusion**

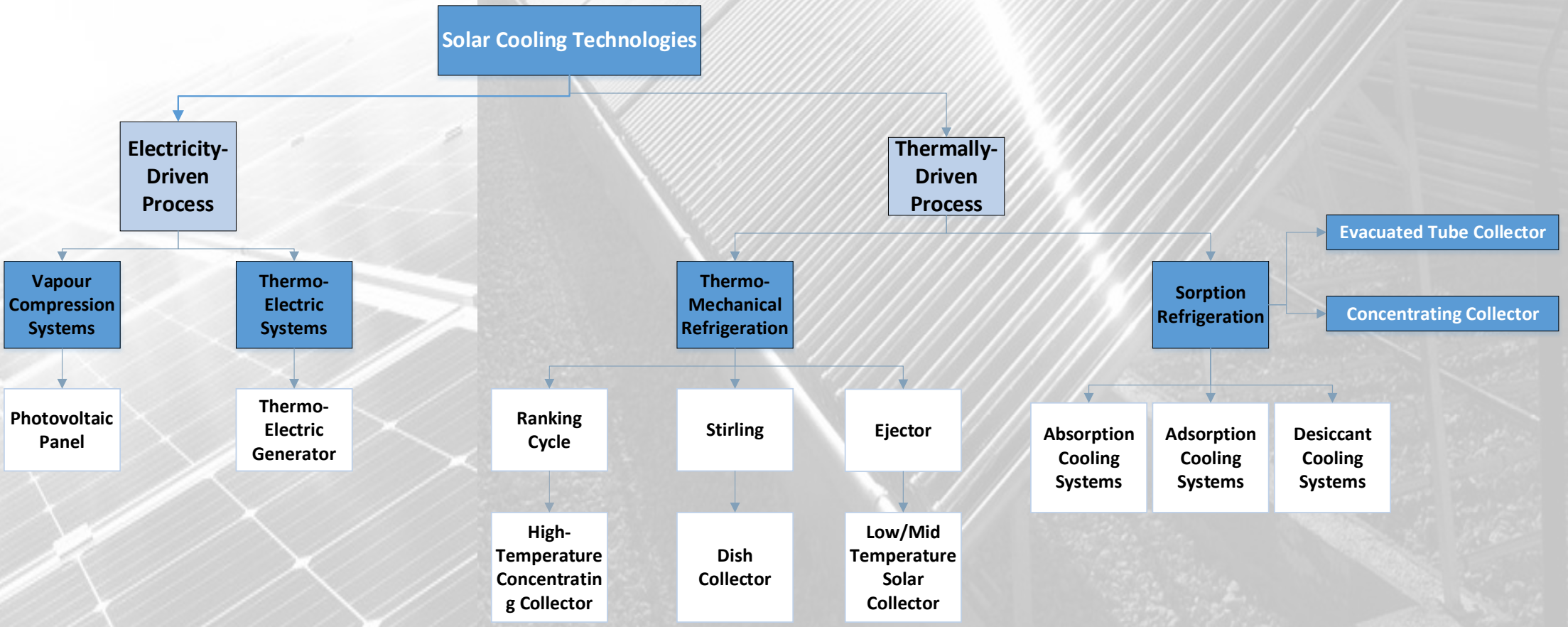
Introduction



Introduction

- Promising option:
  - Façade products integrating solar active cooling technologies
  - Façade surfaces are exposed to solar radiation
  - Need to enable technological innovation

Introduction



Introduction

- Solar active façades (SAFs) defined by (IEA SCH Task 56):

"the envelope systems entailing elements that use and/or control incident solar energy, having one or more of the following uses:

- ***To deliver renewable thermal or/and electric energy to the systems providing heating, cooling, and ventilation to buildings.***
- ***To reduce heating and cooling demands of buildings, while controlling daylight"***

Introduction

- Solar cooling integrated façades defined by (Prieto et al., 2017):

"Façade systems which comprise all necessary equipment to self-sufficiently provide solar driven cooling to a particular indoor environment"

- The development of such building products should consider a certain flexibility

Introduction

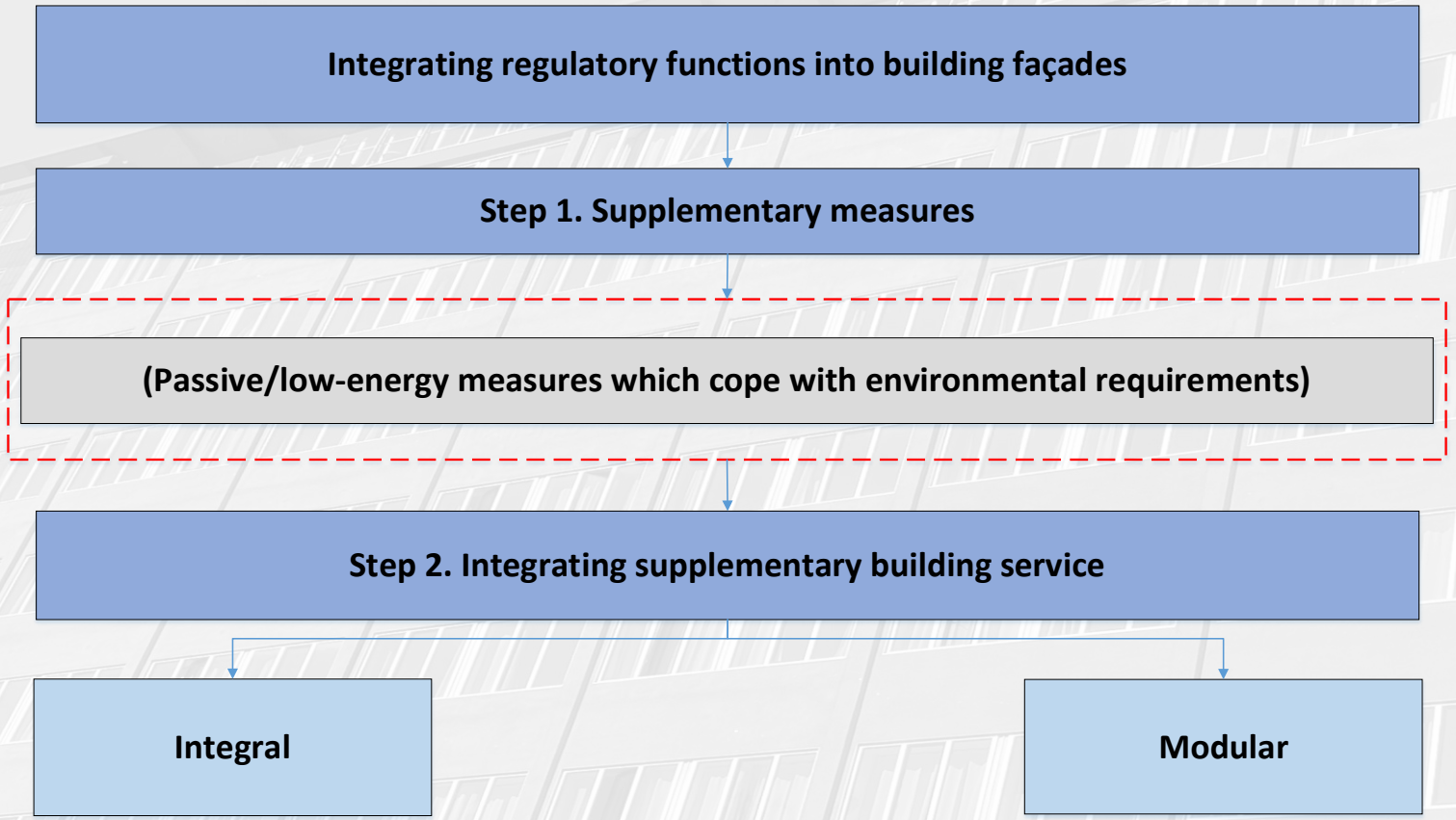
- Need to provide more flexibility while considering previous definitions

- A more practical definition that can be considered:

""Building envelop systems that include elements using and/or controlling solar radiation to deliver self-sufficient solar renewable electric and/or thermal energy needed to generate cooling effect in a particular indoor environment"

Introduction

- Decision-making process for façade integration of regulatory functions (Prieto et al., 2017)



Introduction

- Challenging tasks
  - Selecting the right technology
  - Tackling technical and product-related aspects
- Each technology is different from one another
- Developing such products can be a complex endeavor
- Need to have a conceptuall approach

Materials and Methods

Identified by expert interviews in an earlier stage of the study (Hamida et al., 2023)

Determining key attributes that can be considered in the process of designing and developing such facade products

Determining criteria affecting the technological selection

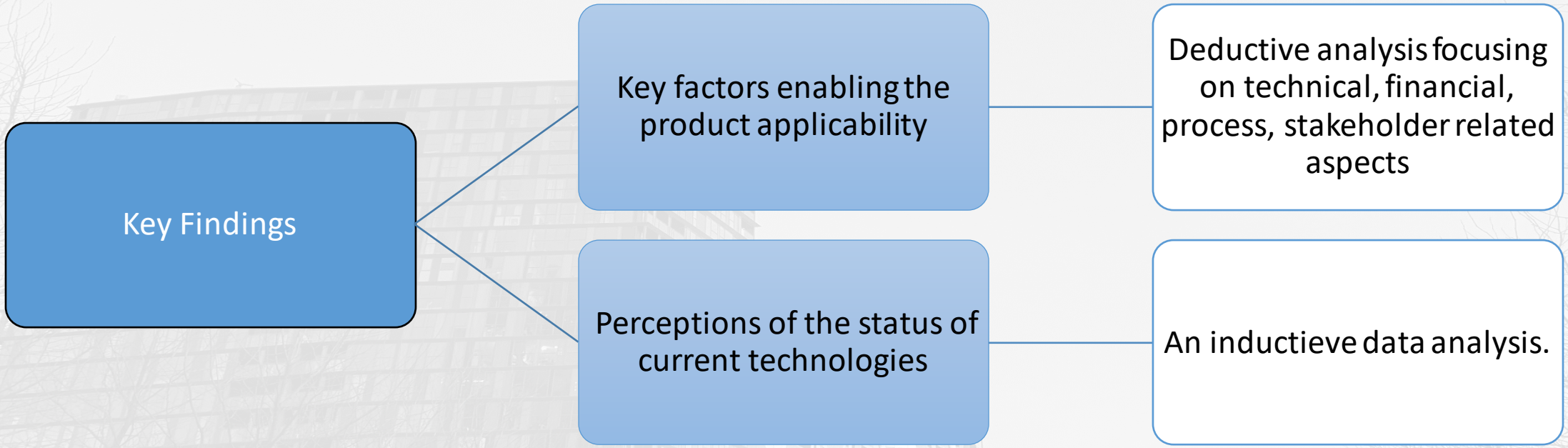
Proposing a conceptual approach to investigate product applicability through combining the outcomes of previous steps

Identified potential quantifiable key factors enabling the widespread application

Aspects identified to affect the status of current technologies

Hamida, H., Konstantinou, T., Prieto, A., Klein, T., 2023. Solar Cooling Integrated Façades: Key perceived enabling factors and prospects of future applications. J. Build. Eng. 76, 107355.

Towards Investigating Product Applicability



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Towards Investigating Product Applicability

- Scope and criteria considered for determining attributes involved in designing and developing SCIFs concept:
  - Sample of the attributes identified from the key enabling factors
  - Various perceived aspects influencing the perception of the status of current technologies

Towards Investigating Product Applicability

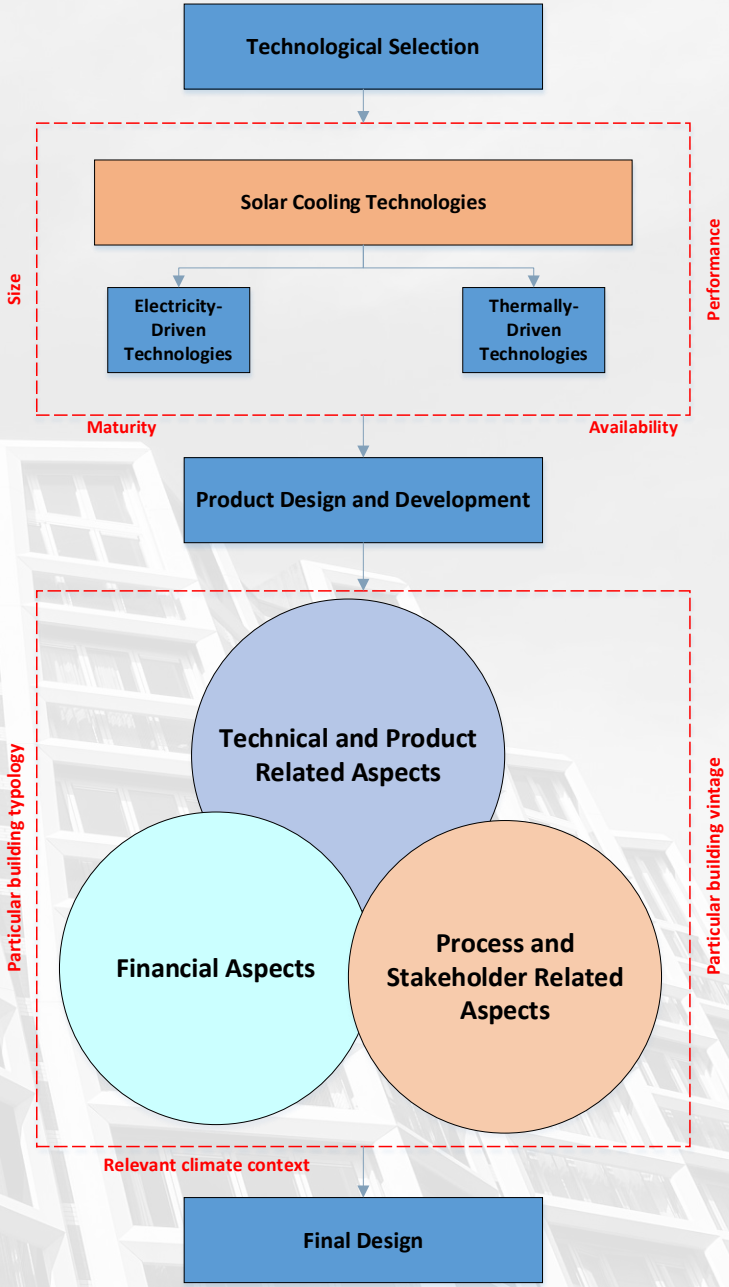
Item	Attribute as a Key Enabling Factor			Selection Criteria as an Aspect Influencing the Perception of the Status of Technologies	
	Related Aspect			Related Technology	
	T&P	F	P&S	Electrically-Driven	Thermally-Driven
Product performance and efficiency	×	×	×	×	×
Compactness and Space Usability (Size)	×	×	×	×	×
Meeting user comfort requirements	×	-	×	-	-
Durability and long life span	×	-	×	-	×

Towards Investigating Product Applicability

Item		Attribute as a Key Enabling Factor			Selection Criteria as an Aspect Influencing the Perception of the Status of Technologies	
		Related Aspect			Related Technology	
		T&P	F	P&S	Electrically-Driven	Thermally-Driven
Financial and life-cycle costs	Project Budget	-	×	×	-	-
	Initial Cost	-	-	-	×	-
	Government Subsidies	-	×	×	-	-
	Taxes and Fees	-	×	×	-	-
	High Energy Prices	-	×	×	-	-
	Operating/Ownership Cost	-	×	×	-	-
	Return on Investment (Payback Period)	-	×	×	-	-
	Ability to Compete Traditional Systems	-	×	×	-	-

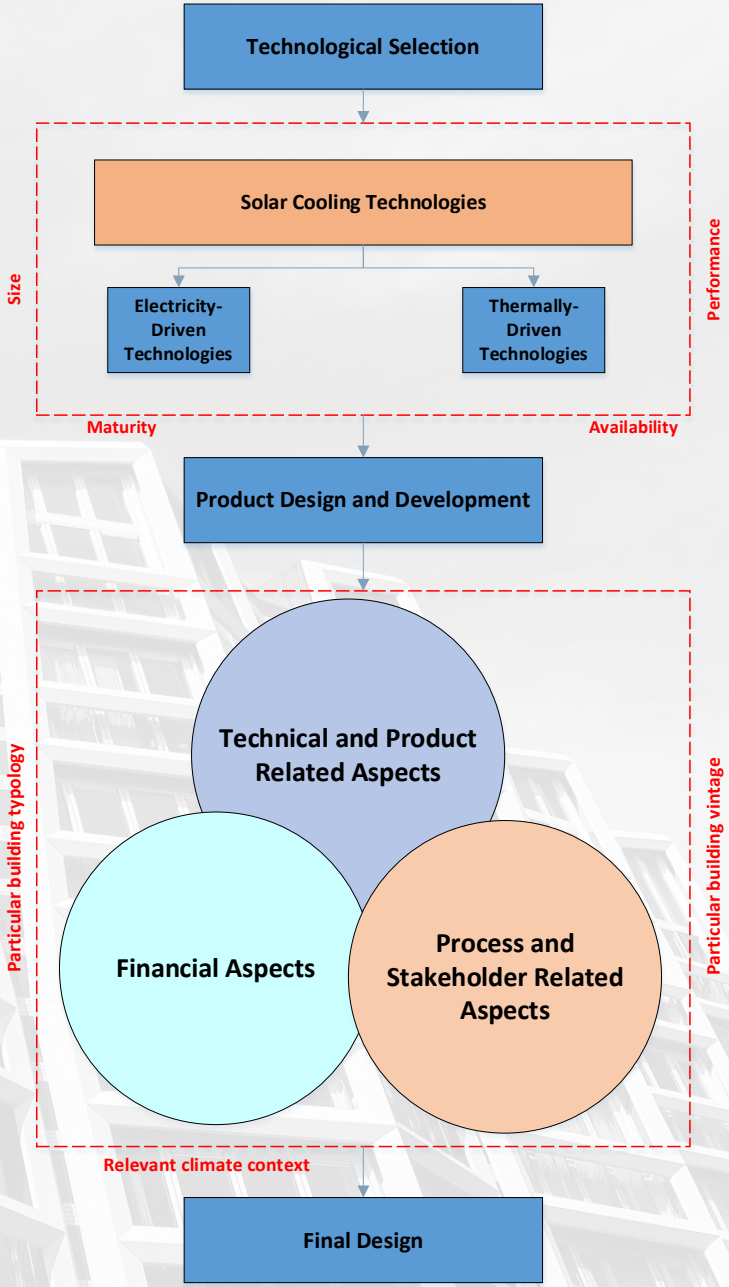
Towards Investigating Product Applicability

- A conceptual approach to investigate product applicability
- Determining a particular technology (involve different criteria).
- The design and development of façade concepts through considering the attributes



Towards Investigating Product Applicability

- Designing and developing façade concepts should consider boundary conditions
  - Focusing on façade products to be used in a particular building vintage
  - Considering a particular building typology
  - Focusing on premises located in particular climate conditions



Conclusion

- Transforming the presented conceptual approach into a product development framework
- Combining various technical, financial, and stakeholder related aspects
- Considering investigating the applicability of particular technologies in relevant contexts.

Thank you