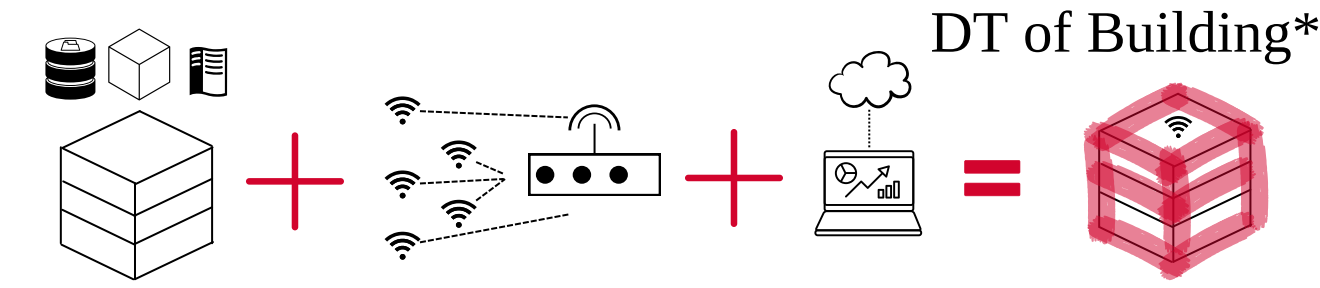


Digital Twin BIM Model for Total Design of Small Buildings



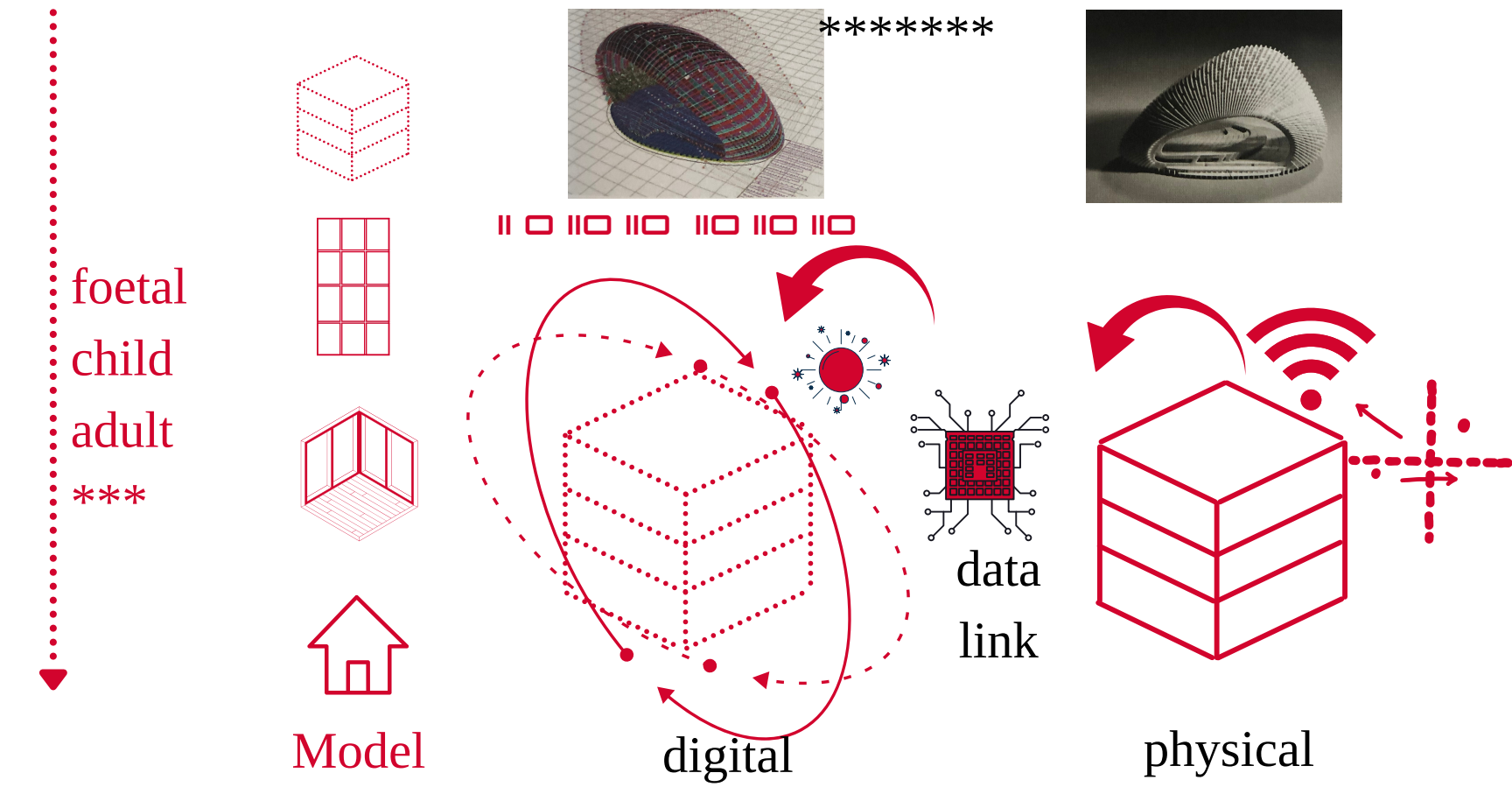
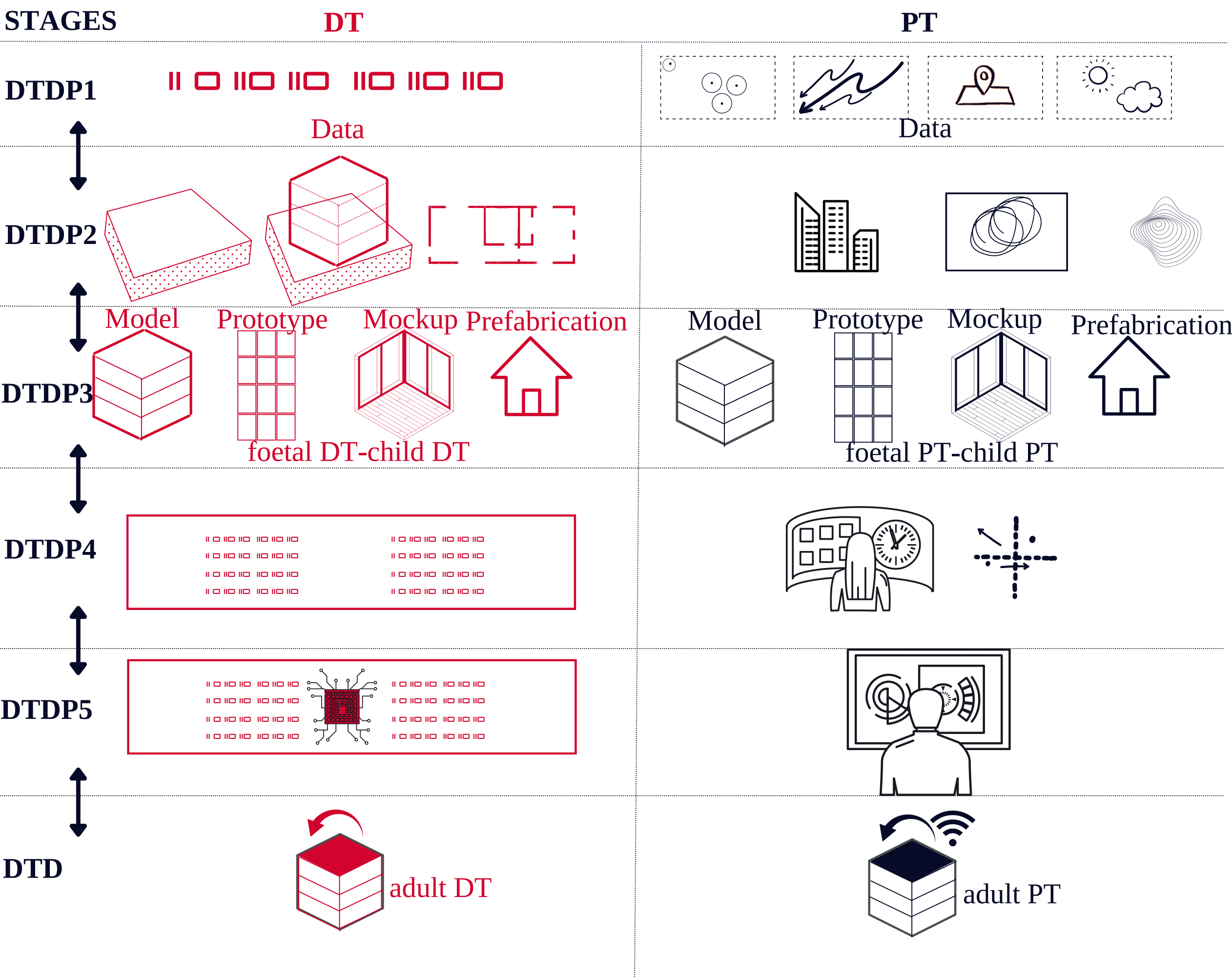
1 Incorporating digital twin technology into the architectural design process

Objective	Impact	Benefit	Theoretical Gap	Bridging gap	Contribution
DT technology in early stages of architectural design process, propose criteria for creating a generic DT of a --small building	Past, present and future design scenarios by enabling --architects to anticipate- solve architectural design problems for optimum results	Facilitating data-driven decision-making in design cycle, enabling exploration of design alternatives within hybrid environments	Limited research on utilizing DTs in design stages before final design*****	Investigating progressive states (foetal, child, and adult stages of DT) and their relationship with design process	Practical understanding and application of DT technology in design process

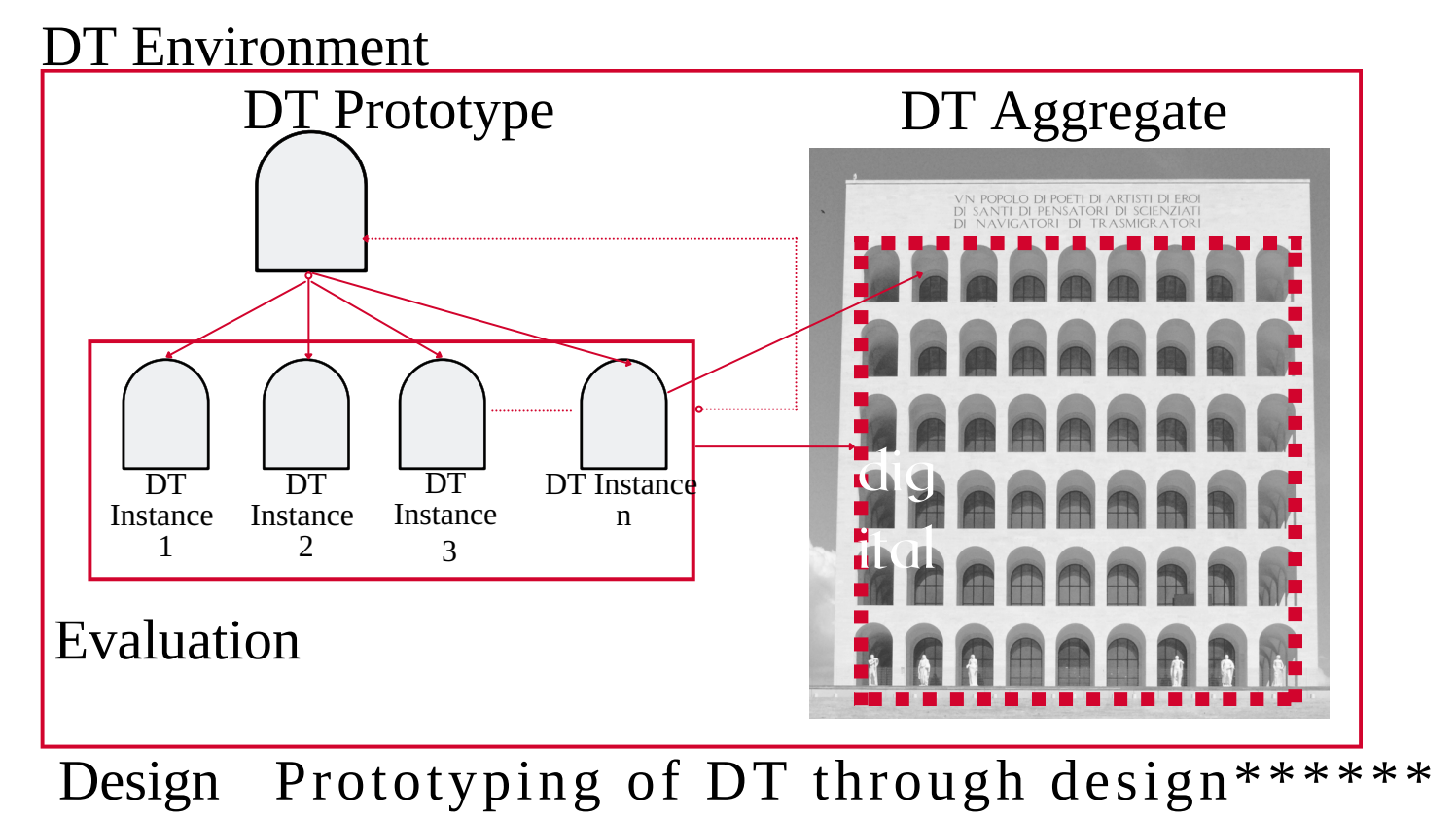
2 Theoretical foundation research framework

Digital Twin in Design Process (DTDP)***** DT technology development layers** + basic design cycle***

Foetal and child DTs may be appropriate stand-ins for adult DTs through design process?



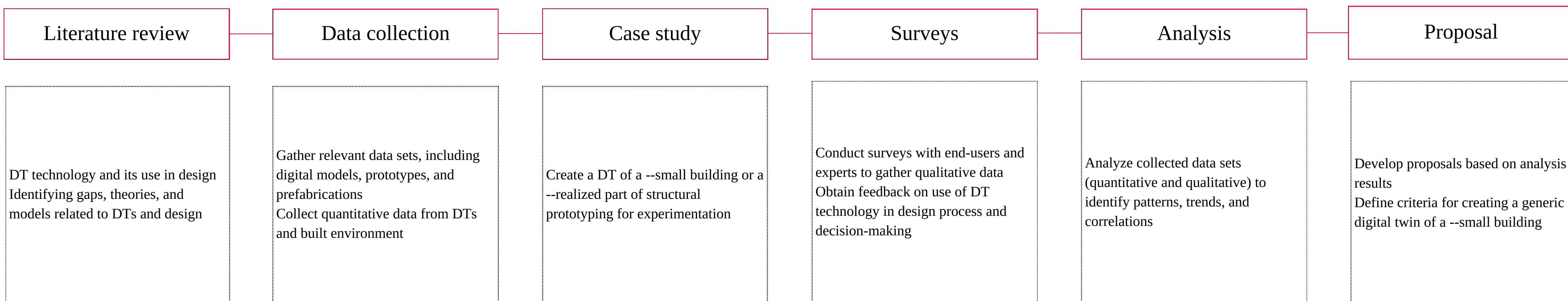
Digital Twin (DT); Hybrid Prototyping; extend physical models simultaneous mirroring**** with digital models supported by DT



3 Theoretical gap research question

Main question	How can DT technology be utilized in design process and its relationship with decision-making during design cycle?
Sub-questions	<p>Are foetal and child DTs useful for design in process towards adult DT?</p> <p>What are criterias to create a generic DT of a small building?</p> <p>Can designers design a building using a DT: devised scenario?</p> <p>What if we already started to use foetal and child physical and digital twins through hybrid prototyping? Hybrid prototyping tools can increase connectivity of digital twin. Many prototypes are produced during design process, but what if adding more sensors makes it smarter?</p>

4 Overall research approach and specific methods



5 Main risks or research challenges

<p>Multidisciplinary</p> <p>Complexity of DT</p> <p>Limited availability of creating a DT related to prototyping in architecture</p>
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Strategies to Mitigate Risks

<p>Collaboration with architectural firms for case studies and data collection</p> <p>Use of multiple data collection methods (surveys, interviews)</p> <p>Collaboration with experts from different disciplines</p>
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- *Khajavi et al., 2019
- **Lu et al., 2020
- ***Roozenburg & Eekels, 1995
- ****Glaessgen & Stargel, 2012
- *****Lim, Stolterman and Tenenber, 2008
- *****Grieves and Vickers, 2017, pp. 94-95; Grieves, 2021, https://en.wikipedia.org/wiki/Palazzo_della_Civiltà_Italiana
- *****Burry and Burry, 2016
- *****Emir Isik & Achten, 2022