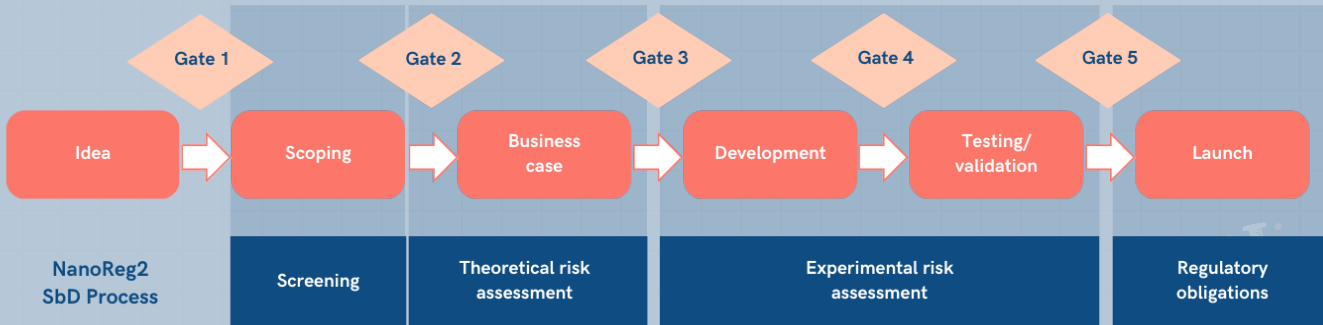


# Integration of Safe-by-Design with Innovation Models

Safe-by-Design (SbD) is an approach that is expected to be applied during the conception and design of new products. As such it needs to be integrated with a company's strategy for innovation. There are several innovation management models designed to streamline product development, clarifying where decisions need to be made, who needs to make them and how they should be made. For SbD to be adopted seamlessly, a clear idea of how it overlaps with these innovation models (IM) is imperative.

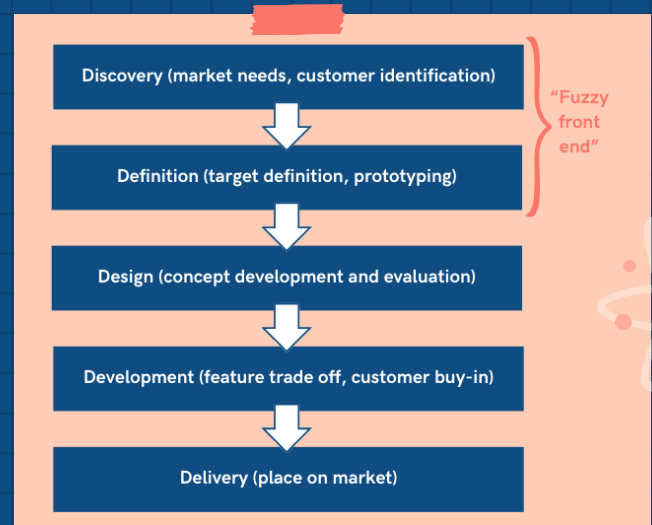
## Cooper Stage-Gate Model

The Cooper Stage-Gate model (in red below) breaks the innovation process into discreet stages. It recommends that once a stage is completed a decision needs to be made regarding whether progress to the next stage is warranted. This is intended to prevent committing resources to projects that are not likely to succeed. The EU project NanoReg2 proposed the application of Safe-by-Design to nanomaterials and demonstrated how it aligns with the Cooper Stage-Gate model.

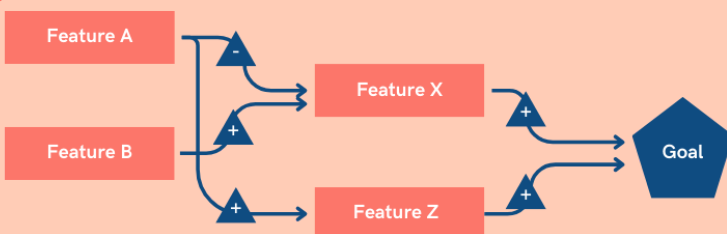


## The "Fuzzy-front end" of product development

- Cooper Stage-Gate model thought to be too focused on the later development stages.
- "Fuzzy front end" concept introduced by Katz(1) to address this weakness.
- Katz defines this as Discovery and Definition, which correspond to Idea, Scoping and Business Case in the Stage-Gate model.
- These steps are characterised by many options that are poorly defined.
- Need funnelling and filtering into a few most promising ideas by testing of prototypes.
- **SbD4Nano decision support tool** is structured to help NM innovators rapidly screen and gain understanding of safety of these prototypes.
- Approach in line with the "fail fast, fail often" strategy recommended for efficient product development.



(1) Katz, G. (2011). Rethinking the product development funnel. <https://ams-insights.com/article/rethinking-product-development-funnel/>



The decision support tool allows the user to examine multiple "influence pathways" towards a user defined goal to understand which features of a product will have the most impact on reaching the goal. It can identify competing and collaborative pathways to address the complex systems of safety and performance. The tool is a tiered system that can use minimal data at preliminary stages, thus allowing for many options to be examined. This aligns closely with the "fuzzy front end" of product development where many options need to be efficiently focused to a small number of candidates for development.