A Prospective Approach for Assessing the Potential Impacts of Nanomaterials to Human and Environmental Health

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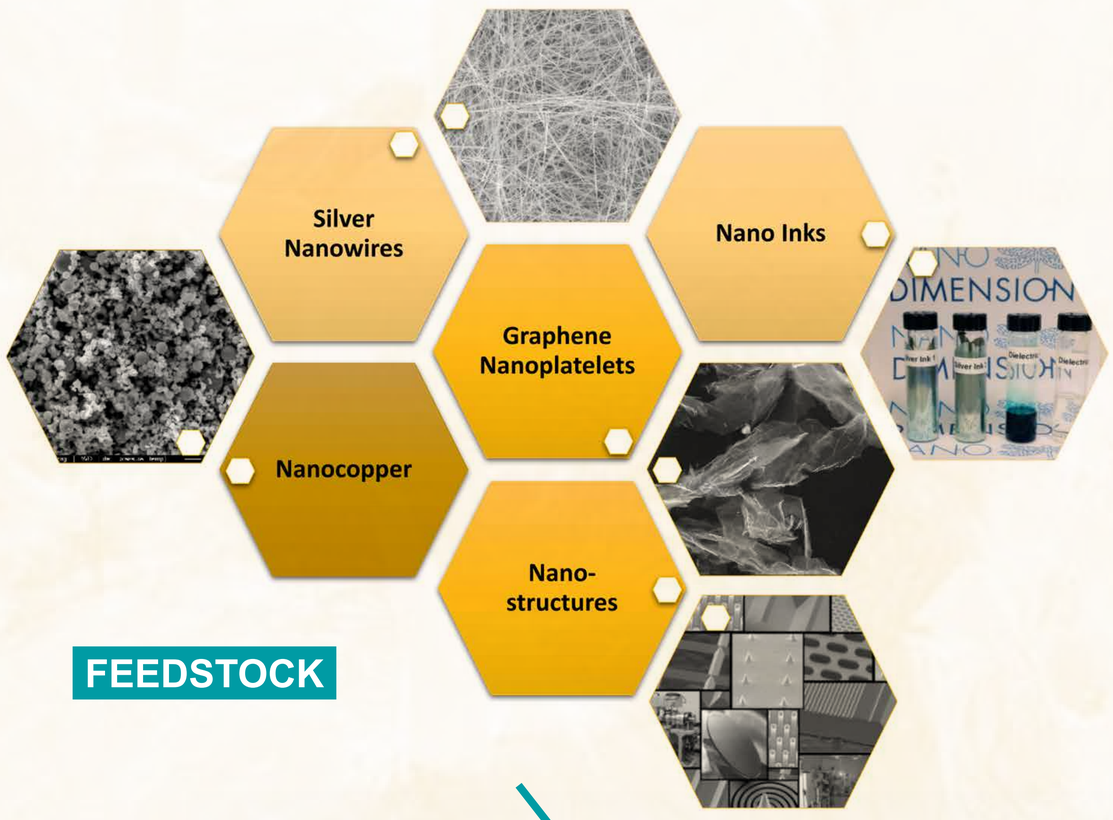
Introduction

Nanotechnology is a growing industry which creates an array of economic and social benefits. Manufactured nanomaterials exhibit new characteristics in contrast to the same material without nanoscale features including increased reactivity, conductivity or strength [1, 2]. At the same time, the use of manufactured nanomaterials raises questions regarding potential unintended risks to humans' health and the environment [3, 4]. These global challenges are addressed in our work with a prospective approach for appropriately assessing the potential impacts of nanomaterials and nano-enabled products.



Material & Methods

Based on state-of-the-art safety assessment approaches/tools (ECETOC TRA, Stoffenmanager Nano and ISO 12901-2) [5-8] we developed a tiered safety assessment strategy. Moreover, to ensure to be in line with current strategies we utilise protocols and experimental set up of assessment which have been harmonised with other initiatives and projects on nanosafety and nanotoxicity (OECD, NanoSafetyCluster, i2L-group, European Pilot Production Network, Hi-RESPONSE, R2R Biofluidics, Scaffold, NanoMICEX, GUIDEnano, NANEX, ITS-NANO).

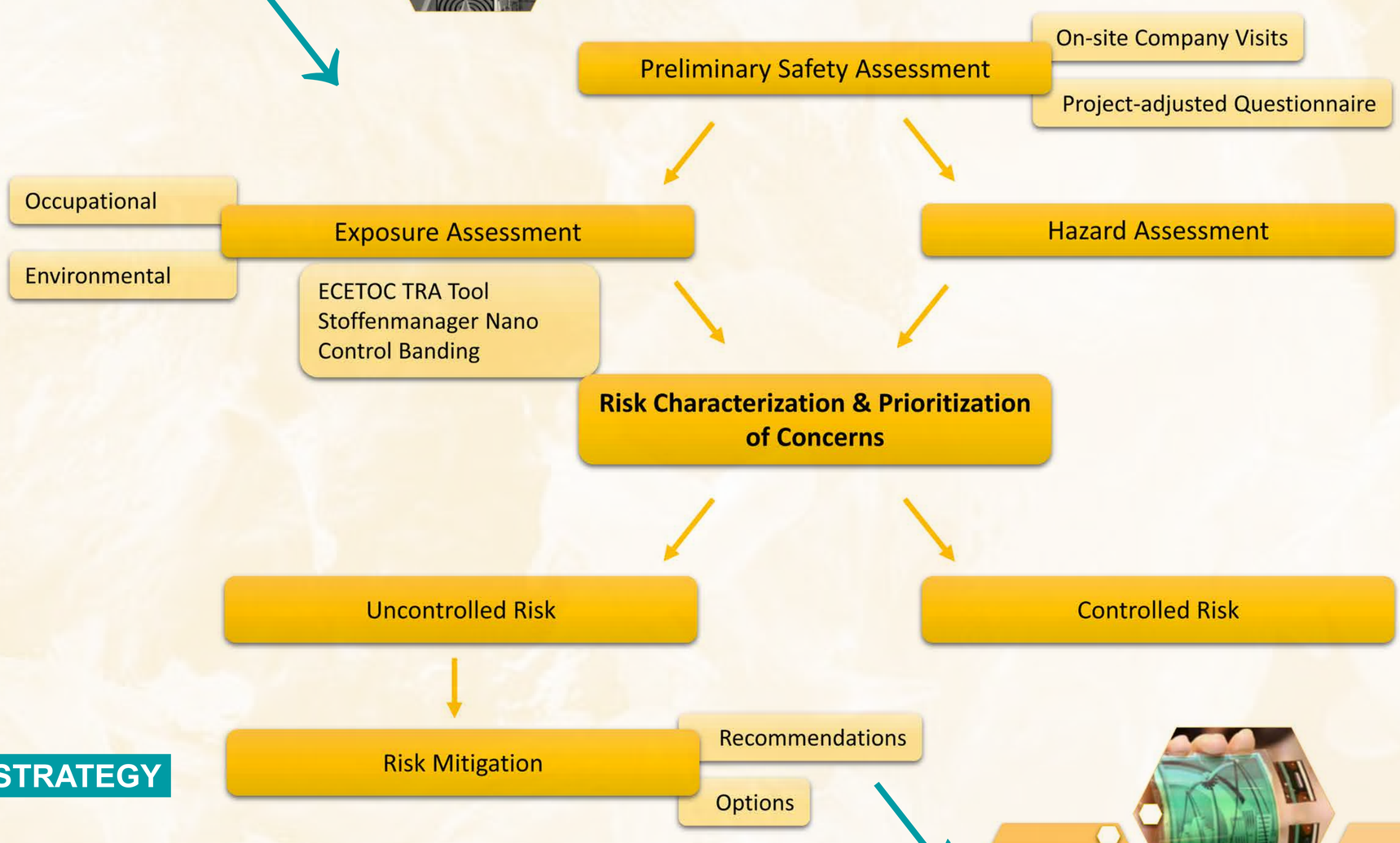
The proposed risk assessment model encompasses 5 main pillars:

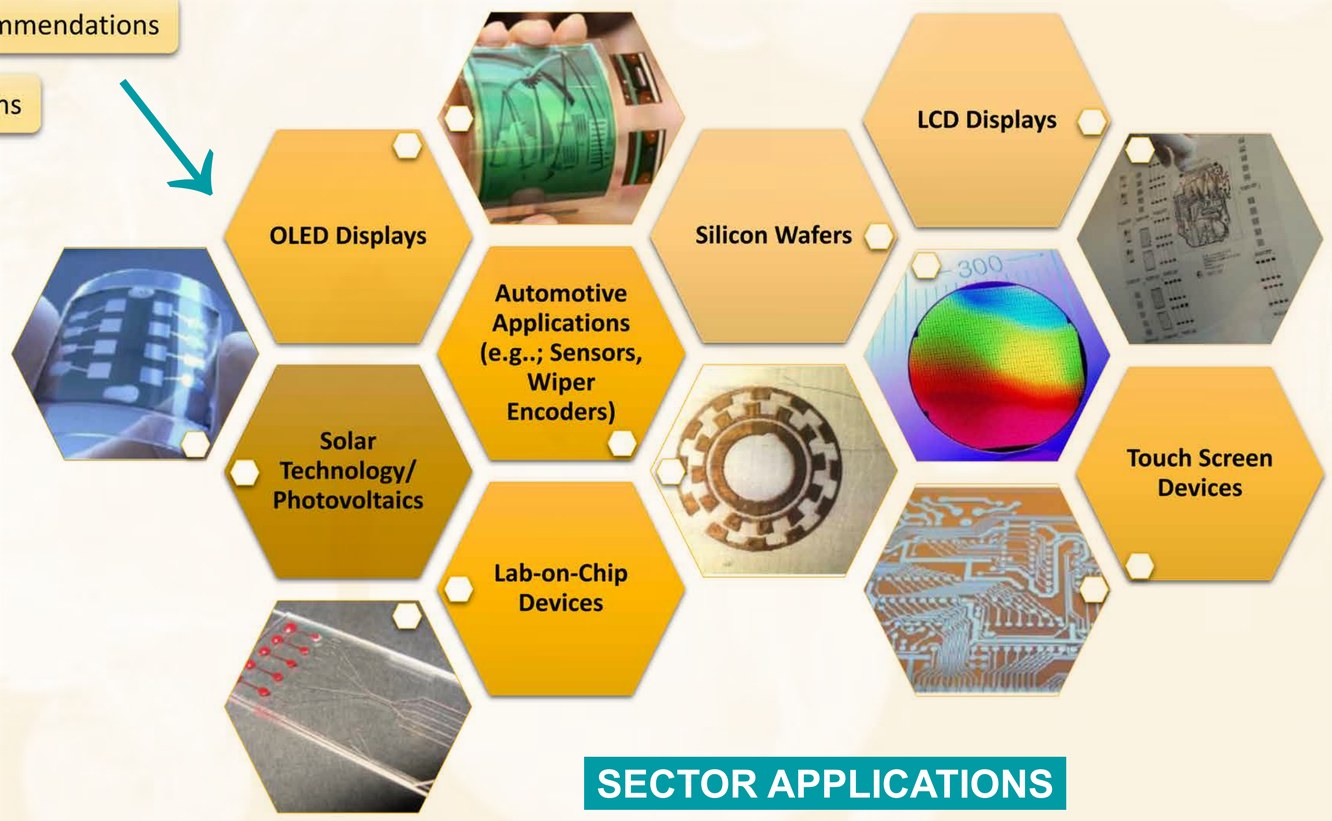
(I) Preliminary Safety Assessment
(II) Hazard Assessment
(III) Exposure Assessment
(IV) Risk Characterization and Prioritization
(V) Risk Mitigation

The central objective of this framework is to identify main scenarios that can increase the likelihood of exposure, focusing on occupational (inhalation and dermal exposures) and environmental exposure (e.g.; classify which materials and/or process operations pose greater risks, where these risks occur in the product life cycle, and the impact of these environmental risks on society). For each scenario, exposure values are calculated according to the selected/assigned parameters such as the frequency and duration of exposure, the presence of a local exhaust ventilation (LEV) etc.

Conclusion

This prospective approach for assessing the potential impacts of nanomaterials will substantially assist in defining critical hotspots, may help to assist in determining whether these effects require action (modification of production systems, regulations, etc.) or not. Future work will aim on the development of tailored (risk) mitigation plans, further elaborated on cross-sectorial applicability, and by this, will be designed to manage, or reduce risk to meet an acceptable level, ensuring regulatory preparedness.





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