Critical Factors for the Commercialisation of Nanotechnology
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Background

Nanotechnology is regarded as the 21st century’s answer [1] to alleviate “global social challenges” [2], yet to date this technology has not reached its full potential. Understandably, the challenge for nanotechnology to enjoy the pinnacle of success is because it is plagued by much controversy around health risks [3], [4], its potential toxicity [3] and the formation of free radicals [5], among others, while notwithstanding the complexities it experiences in reaching the market in the absence of suitable commercialisation models [6], [7]. Even very well managed organisations struggle with the effective transition of scientific and technological ideas from the research laboratory to the consumer through the operational and transformational processes of production, marketing and sales.

Statement of the Problem

Commercialisation, particularly in the Nanotechnology fraternity is an arduous task due to the illusive behaviour of engineered material [7]. Because experimental methods of materials design, synthesis and selection can be costly and time-consuming leading to long development times, empirical analysis and modelling are advantageous for the practical development, optimisation and commercialisation of nanoscale materials.

Hence, the essential and sufficient need to identify the critical factors and to develop theories for the effective and efficient commercialisation of engineered nano-materials.

Project Aims and Objectives

This study identified and evaluated the main critical factors essential for effective and efficient commercialisation of engineered nano-materials by using quantitative business models and expert opinion. Major factors which influenced the commercialisation of nanotechnology were identified through a series of literature reviews and surveys with nanotechnology experts. Common characteristics for the achievement of successful commercialisation of nano-induced products were identified.

Objective 1: Used literature and a survey of researches to present critical factors for the commercialisation of applications containing engineered nano-materials

Objective 2: Used Analytical Hierarchy Process to prioritize the identified critical factors for effective and efficient commercialisation of engineered nano-materials

Methodology & Research Design

This study adopted a purposive sampling method. The research paradigms adopted for this study were quantitative and qualitative. From a quantitative perspective, the Delphi Method and Analytical Hierarchy Process was adopted for optimal decision making in the commercialisation of ENMs’ applications. The qualitative perspective followed a case-study research approach and interviewed researchers (10) from the Durban University of Technology (DUT). The goal of surveying the researchers was to gain an understanding of the variables that are considered critical. An average of ten (10) to fifteen (15) experts is needed in a Delphi panel to produce good results [8].

Results & Discussion

This research identified and evaluated several critical factors for effective commercialisation of engineered nanomaterials (ENMs) through a review of recent and current literature and suggestions of academic experts in nanotechnology through the Delphi method. Thirty-four (34) critical factors grouped into ten (10) dimensions were identified and evaluated for importance and subsequently for priority scaling. The Analytical Hierarchy Process (AHP) technique was further used in the evaluation of these critical factors for effective nanotechnology commercialisation decision making. Centred around the consideration of literature and survey of experts, ten factors were identified. Based on the experience of the experts in their respective areas of study, a made was towards the rating of the significance or importance of the factors for nanotechnology commercialisation listed for the purpose of developing quantitative models essential for facilitating new technological commercialisation decision making. These factors were derived from various research articles in literature and proposed in the questionnaire. Table 1 summarizes the responses and the ratings of these factors.

The consistency ratio (CR) is computed after the matrix formation. The essence of the CR is to determine the trustworthy, in terms of their consistency, of the experts’ judgments. From figure 1, it is expected for every resulting CR to be a maximum of 10%, otherwise it can be concluded that the whole ranking process is unreliable. The process of pairing comparison continues and the critical factors are reduced to less than or equal to 0.1 is obtained. Subsequently, the weight or priority ranking is carried out. The pair wise comparison technique is commonly used to handle subjective and objective judgments in multi-factors decision making [9].

Conclusions & Recommendations

This analytical approach supported the quality control and commercialisation decision making process. A strong recommendation was made for robust fundamental research for viable commercial production and improvement for enhancement of nano eth. It is expected that the critical factors will be used by policy-makers and scholars and serve as the input for the Science and Technology platform development.

References & Acknowledgements


Table 1: Experts’ rating of the importance of the factors for nanotechnology commercialisation

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Figure 1: Analytical Hierarchy Process modelling flowchart (Adapted by the researcher)

Figure 2: AHP Priority Model of the critical factors and sub-factors

Figure 2 (continued): AHP Priority Model of the critical factors and sub-factors

Figure 3: Critical Factors for the Commercialisation of Nanotechnology

Table 2: Hierarchy Ranking of critical factors

<table>
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Appendix A: questionnaire

Appendix B: Survey results

Appendix C: AHP prioritisation method

Appendix D: Expert’s opinion...