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RESEARCH ARTICLE:

Regulation of Nanotechnology and Nano-Enabled Products: The Implications of the Consumer Protection Act 68 of 2008 in South Africa

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Abstract

Scientific advancements in nanotechnology have made it a popular choice in the business fraternity particularly because of its versatility in numerous applications, including nanomedicines, food products and cosmetics. However, there are potential risks associated with its use and exposure, especially to employees and consumers. The purpose of this literature review was to examine the implications of the Consumer Protection Act (CPA) 68 of 2008 for nanotechnology and nano-enabled product (NEP) regulation in South Africa, particularly in the absence of regulations specifically relating to such technology and products. The objectives include an analysis of the consumer and manufacturer challenges and risks associated with the application of nanoparticles and nanomaterials, followed by an examination of the implications of the CPA for such application. The methodology entails an interdisciplinary research approach from an applied legal perspective with reference to literature and relevant legislative provisions. The evidence available on the challenges associated with NMs and NEPs suggests that such material and products are not without risks and potential hazards for the consumer. The CPA creates both obligations for business and rights for consumers. However, more conclusive scientific evidence is required to understand these issues and adequately protect the consumer through explicit legislation and regulations.

Keywords: *consumer protection act (CPA); engineered nanomaterial; engineered nanoparticles; international standardization organization (ISO); nano-enabled product*

Introduction

Nanotechnology is increasingly being used by businesses to re-invent themselves by maintaining or improving their competitive advantage, sustainability, and global appeal because of its versatility in applications and its suitability to a wide range of disciplines, including manufacturing, medicine, construction, food security and environmental management (Talibian *et al*., 2020 and Rai *et al*., 2021). Despite the competitiveness and usefulness of nanotechnology, there are potential risks and hazards associated with its use and exposure (Beumer, 2017). Such challenges range from health risks (Poland *et al*., 2008, cited in Delgado, 2010) to the toxicity of nanoparticles in crops (Yang and Watts, 2005) and the movement of nanoparticles from food packaging to food material (Sahoo *et al*., 2021). Nanotechnology could also result in the formation of free-radicals (Bumbudsanpharoke and Ko, 2015) and reactive oxygen species (Naidu, Govender and Adam 2015) which cause severe diseases. Hence, there are serious ethical and regulatory challenges inherent in such technology and products. Risk management and governance by both governments and businesses in the nano-field are essential (Renn and Roco, 2006).

Nanotechnology applications have the potential to directly address the needs of developing countries (Beumer, 2016). The development of the National Nanotechnology Strategy in 2005 made it clear that there was potential for South Africa to be involved in such technology.

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Consequently, the Department of Science and Technology's Ten-Year Innovation Plan 2015 and the South African National Development Plan Vision 2030 have identified key imperatives to use nanotechnology applications to improve the economy of the country and quality of lives of citizens, particularly in energy, water and sanitation, food security and minerals and mining sectors (Department of Science and Technology 2006; Saidi and Douglas 2017; Prasher and Sharma, 2021 and Masara 2021). The article focuses on nanotechnology (engineered nanoparticles (ENPs) and engineered nanomaterials (ENMs)) and their context in business in South Africa, and the implications that the Consumer Protection Act 68 of 2008 (CPA) (Republic of South Africa, 2008) has for such applications. Lessons from the South African experience will provide manufacturers and suppliers with the foresight to manage and control nano-enabled products in the context of consumer protection in their milieu. Clearly, technology, business and regulatory concerns cannot be regarded as separate issues (Martin and Freeman, 2004; Matatiele *et al.,* 2018 and Joubert *et al*., 2020).

In addition, South Africa plays a leadership role in policymaking in Africa. Developments in this area are significant for the region, as well as for developing countries generally. The methodology entails an interdisciplinary research approach from an applied legal perspective with reference to literature and relevant legislative provisions. The first section explores the background, functions, and characteristics of nanomaterials (NMs) and links nanotechnology with business. The second section presents the consumer and manufacturer challenges and risks associated with the application of nanoparticles (NPs) and NMs. The third section briefly mentions the state of NMs regulation internationally. The fourth section examines the implications of the CPA for nanotechnology and nano-enabled product (NEP) regulation in South Africa, as well as its significance, particularly in the absence of regulations specifically relating to such technology and products. Considering the nature and risks associated with NMs and NEPs, this section examines the various provisions in the Act and their application to the nano consumer-business transaction. The article closes with recommendations and highlights some of the regulatory considerations for business regarding nanotechnology and NEPs.

Background to Nanomaterials and Nanoparticles

Nanoparticles emerge from naturally occurring or man-made sources. Arising from both sources, nanoparticles have been in the world and around people for a long time. Naturally occurring nanoparticles include organic (such as viruses, proteins, and polysaccharides) and inorganic compounds which are formed through volcanic eruptions, weathering, and microbial processes (Heiligtag and Niederberger, 2013: 262). Such naturally occurring nanoparticles are present in the Earth's atmosphere, hydrosphere (oceans, rivers, and ground water), lithosphere (rocks, soil, and magma) and biosphere (comprising all microorganisms, and higher organisms, including humans). They are found in volcanic ash, in fine sand and in organic matter such as viruses (Jeevanandam, Barhoum, Chan, Dufresne and Danquah, 2018: 1050). Nanomaterials are produced by biological species (including viruses) or are man-made through engineered process. Engineered material can be found in medicine, construction, food, sports equipment, and cosmetics, among others. Engineered nanomaterials are typically produced by mechanical grinding, engine exhaust fumes and smoke, or synthesized by physical, chemical, biological or hybrid methods (Jeevanandam *et al*., 2018: 1050).

Carbon-based nanomaterials have numerous biomedical applications, including the early diagnosis of cancer, imaging, targeted photothermal therapy, drug, and gene delivery to targeted tissues, tissue engineering, tumour destruction, (Zhang, *et al*., 2014: 232; Salata, 2004), bio-detection of pathogens, detection of protein, probing of DNA structure and MRI contrast enhancement (Saini, Saini, and Sharma, 2010: 32-32). Nanomaterials can improve the strength, durability, lightness, and conductivity of materials (Nasrollahzadeh *et al.,* 2019). They can make available the useful properties (such as self-healing, anti-freezing, and anti-bacterial properties) of such materials and improve their reinforcing and safety capabilities. Nanomaterials are used in anti-bacterial technology for consumer products such as washing machines, air-conditioners,

and refrigerators. In the automotive industry such materials are used to improve tyre adhesion to road surfaces and to produce scratch resistant paint finishes. They have also been used commercially in solar cells with "dye-sensitization" ability, and in the pharmaceutical industry (Jeevanandam, *et al.,* 2018: 1054). In the food industry, nanotechnology can be helpful in enhancing the taste or nutritional benefits of food, as well as improving the texture of rich foods without adding calories (Dekkers *et al*., 2011), notwithstanding its ability to provide smart packaging to detect bacteria and pathogens in food (Nasrollahzadeh *et al.,* 2019).

Nanomaterials and nanotechnologies can be made to interact with tissues and cells at a molecular level for use in medicine and physiology, thereby enabling integration between technology and biological systems, which could not be achieved previously. By controlling drugs and other materials at the nano scale, the bioactivity of materials can be modified (Saini *et al*., 2010 and Nasrollahzadeh *et al.,* 2019). The use of non-pathogenic viruses has unlocked a new area of nanotechnology particularly in the detection, imaging, and treatment of human diseases. Bio-nanoparticles that originated from plant, animal or bacterial viruses are useful in protein delivery or drug delivery (including the treatment of breast cancer). The use of virus nanoparticles can assist in reducing the frequency of drug administration and treatment costs (Esfandiari, Arzanani, Soleimani, Kohi-Habibi and Svendsen, 2016). However, only an insignificant proportion of viruses are pathogenic (Zobell and Rittenberg, 2011).

The versatility of nanotechnology clarifies the need for a multidisciplinary approach for business, law, and science to co-exist and even depend on each other for this technology to reach its full potential and success (ISO 12885, 2008). This is evident in nanotechnology's contribution to these fields as it is revolutionising traditional practices and creating new and radical ways of making products and doing business. For example, in manufacturing carbon and silicone at nanoscale, unique and 'unexpected' characteristics from its bulk form are indicated, which adds tremendous strength, chemical reactivity and electrical conductivity to its nanoform, making it very attractive to a wide scope of applications from aeronautics to cosmetics and the food industry (ISO 12885 2008). Nanomedicine is becoming very useful, particularly in cancer treatment and in targeted drug delivery. It is also useful in construction, for enhancing material strength and monitoring structural integrity. Nanoagriculture is showing promising benefits in soil enhancement, speed of crop growth and increased crop yield (Nasrollahzadeh *et al.,* 2019), and it is very favourable for on-site pollution rehabilitation and site treatment (CRO Briefing 2010). There are a few applications of nanotechnology in consumer products already on the market, including sports goods, tyres, cosmetics, therapeutic treatments, water filters, aeronautics, electronics, renewable energy, transportation, weapons, agrochemicals and nutrients, antimicrobial nanoparticles, and active and intelligent packaging (Delgado, 2010; Menta *et al*., 2015 and Nasrollahzadeh *et al.,* 2019).

Arising from these applications of nanotechnology, a major concern is whether consumers are adequately prepared in terms of their awareness and understanding of nano-enabled products and their acceptance of the associated risks. The purpose and objective of the Consumer Protection Act 68 of 2008 (CPA) includes the protection of the consumer from possible harm; ensuring transparency and disclosure; and promoting fair and just consumer transactions. Resonating with the foregoing commentary, this study will deliberate the degree to which the CPA is prudent and adequate for nano-enabled products especially since these products are emerging rapidly, and some are on the market ahead of mandatory regulations. In addition, there are significant ethical and legal challenges for business concerning nano-enabled products and their associated risks, especially for the consumer.

The Nature of Nanomaterials

Nanoparticle size typically ranges from 1nm to 100nm with haemoglobin around 7 nm, viruses around 10-100nm (Masciangioli and Zhang, 2003) and human hair around 60-120 000 nm (National Institute of Health 2015). Nanoparticles can emerge from natural, incidental, or

engineered means (Nasrollahzadeh *et al.,* 2019). The small size of these particles is of concern because they become airborne easily and can therefore be inhaled, and they may penetrate the skin more easily than larger particles (Tsuji *et al*., 2005: 43; ISO 12885, 2008 and ISO 13121, 2011). The small particles have been shown to penetrate cell membranes and the human blood-brain barrier (ISO 12885, 2008).

Some of the concerns with NEPs and ENMs are that they behave differently from their bulk material counterparts thus creating unique properties (Thomas *et al*., 2006; ISO 12885, 2008; Bumbudsanpharoke and Ko, 2015). There is also a danger of overlooking risks because manufacturers are advised to adapt established risk assessments from bulk counterparts for NEPs and ENMs. In addition, researchers and governments are apprehensive that the behaviour of ENP and ENMs has not been established yet and very little is known about it. It has also been suggested that these ENPs will behave differently between applications thus requiring its management on a case-by-case basis (Goldman and Coussens, 2005; Coles and Frewer, 2013; European Commission (SCCS) and Hoet, 2016 and Rose *et al*., 2021). Further, the lack of uniformity of behaviour and the minimal historical data for ENPs and ENMs creates uncertainties in the validity and reliability of available data for actual experiments and for predictive modelling (Delgado, 2010), making regulations difficult and nearly impossible at this stage. Moreover, commercial products engaged with nano-processes and containing ENMs are constantly emerging in the consumer market ahead of regulations (Walsh, Balbu, Denison and Florini, 2008).

The possible challenges of nanomaterials include consumer health risks. The structure of certain ENMs is similar to those of asbestos, suggesting possible health risks (Muller, Haux and Lison 2006; Poland *et al*., 2008, cited in Delgado, 2010). Consequently, potential liability costs could be a challenge (Walsh *et al*., 2008). In addition, studies have indicated, *inter alia*, the toxicity of aluminium nanoparticles in the growth of corn, soya beans and cabbages (Yang and Watt 2005, cited in Delgado 2010). There is great unease since ENPs can be inhaled or be absorbed through the skin and can cross biological barriers (Yong, Zheng, Chen, and Chang 2007; Coles and Frewer 2013). It can be inferred that, in areas where nanotechnology is deemed to be beneficial, there is also the potential to cause harm (Sass, Simms and Negin, 2006; Amenta, Aschberger and Arena 2015). In 2006, 77 consumers were reported to be intoxicated by a German bathroom product containing nanoparticles which, apparently, was not indicated on the label; in another instance, two Chinese employees working with engineered nano-paint (30nm) lost their lives and five were reported to be sick with pulmonary disease after being exposed to the product for 5-13 months (Delgado, 2010).

From the widespread use of nanotechnology in the different sectors, it is apparent that risk management considerations regarding the effects of ENMs on employees, consumers and the environment makes sense (Walsh *et al*., 2008). There is therefore an urgent need for NMs to be regulated (Kreyling *et al*., 2006, cited in Coles and Frewer, 2013).

Observations on Nanomaterial Regulation

As far as the regulation of nanotechnology at a global level is concerned, there is not much change on the regulatory landscape since 2003 (Sahoo *et al*., 2021) and therefore, there is a governance gap; the uncertainty about their risk poses a dilemma for regulators (Faulkner and Jaspers, 2012). According to Menta *et al*., (2014: 465), specific sector legislation in the European Union (EU) that provides a binding framework for manufacturers, importers, and users to ensure that substances and products on the market are safe, also applies to NMs and nano-enabled products. Furthermore, the need to adapt existing provisions has led to the amendment of certain EU regulations. In addition, several pieces of EU legislation explicitly regulate NMs, including the Provision of Food Information to Consumers (1169/2011); the Regulation on Plastic Food Contact Materials and Articles (10/2011); and the Cosmetic Products Regulation (528/2012) (Amenta *et al*., 2015: 465).

The US makes use of existing legislation (such as the Toxic Substances Control Act and the Food, Drug and Cosmetic Act) to address the application and impact of NMs (Utembe and Gulumian, 2013: 16-17). The US Federal Food, Drug and Cosmetic Act, which deals with the safety of food additives and food contact materials, does not contain any specific provisions for nanotechnology-based products, while the Food and Drug Administration (FDA) has published specific guidelines relating to the application of nanotechnology. The FDA does not consider all products containing NMs as "intrinsically hazardous" but proposes a "case-by-case" approach. In Switzerland, the safety of NMs is ensured by existing legislation. In Canada and South Africa, no specific regulation for nano-based foodstuff has been introduced and these products are regulated under existing legislation (Amenta *et al*., 2015: 465-472).

Although countries are interrogating the suitability of their existing regulations for nanotechnology, only the EU and Switzerland have included nanotechnology considerations into their existing regulations (Amenta *et al*., 2015). Further, governing bodies in the US, Canada, EU, South Africa, Asia, and Oceania acknowledge the difficulties associated with managing and controlling nano-enabled products. Hence, programmes have been initiated and funds have been allocated to accelerate research and establish reasonable practices to guide current legislation for nanotechnology (Bumbudsanpharoke and Ko, 2015). Presently, the contribution of nanotechnology is in its infancy and therefore it cannot be adequately established yet whether it does no harm or does good, and hence, whether it is fair and just to the consumer. This also brings into consideration the customers' right to fully understand the risks and hazards associated with NMs and nanoparticles and thereby make an informed choice and decision about their purchase (Coles and Frewer, 2013 and Miah, 2017).

In setting out regulatory measures for substances that could have risks for humans, one must distinguish between *ex ante* and *ex post* regulatory measures. The *ex-ante* measures are intended to ensure that products that are potentially hazardous are prevented from getting into the market, whereas *ex post* regulatory measures are intended to deal with challenges arising from the use of the product, such as liability for harm and compensation for damages. In South Africa, regulatory measures falling into the first group (*ex-ante*) includes firstly the Hazardous Substances Act (15 of 1973) in terms of which certain substances are declared hazardous and their sale or use is prohibited or restricted to those who have been granted a licence. Secondly, these measures include the National Environmental Management Act (107 of 1998), which prohibits or controls substances that are a threat to human health or the environment. Thirdly, the Occupational Health and Safety Act (85 of 1993) sets out safety standards for employers and users working with hazardous chemicals.

The second category of regulatory measures relating to challenges, such as health challenges, arising from the use of a product, and liability for harm caused, include the common law remedies available in terms of the law of contract, the CPA and the Food, Cosmetics and Disinfectants Act (54 of 1972), which contains provisions that are broad enough to apply to NEPs. The latter Act regulates the labelling of such products. For instance, products containing synthetic nanosilica, a food additive that serves as an anti-caking agent, comply with the Act by disclosing "E551" in the ingredients list on labels. Silica is the main component of food additive E551 (Peters 2010; Contado, Ravani and Passarella 2013). The extent to which this disclosure on labels is useful to South African consumers requires scrutiny. It is submitted that such disclosure on labels for NMs, in its current form, is inadequate because it is not informative to the diverse consumer context in the country. Since none of the measures in the first category specifically mention nanotechnology, this article seeks to examine the implications of measures in the second category, viz. the CPA, in regulating nanotechnology and NEPs. The CPA does however cover certain aspects that regulatory *ex ante* measures would address, such as those relating to hazards in goods and the safety aspect.

The traditional law of contract (common law) resulted in inequality between contracting parties, with the more dominant party (i.e., the supplier/business) dictating the terms of the agreement. The CPA is important because of such inequality between suppliers and consumers.

The preamble to the CPA acknowledges the imbalances of the past and addresses social and economic inequalities, which came about, particularly because of apartheid, and aims to establish national norms and standards relating to consumer protection. The purposes of the CPA are, *inter alia,* to promote and advance the social and economic welfare of consumers in South Africa; to establish a consumer market that is fair, accessible, and sustainable; and to promote fair business practices. It serves to improve access to the information necessary for consumers to make informed choices; to protect consumers from hazards to their well-being and safety; and to develop effective means of redress. The Act also aims to protect consumers from unreasonable, unfair, and improper trade practices, as well as to provide for an effective and efficient system of redress (Section 3). Although the CPA does not make specific reference to nanotechnology or nano-enabled products, the provisions in the Act are worded in broad and general terms to cover the various types of products, including emerging technologies such as nano and NEPs.

The scope of the CPA is wide, as it applies to any goods or services promoted or supplied in South Africa (Marus, 2011: 36). The Act defines the term "supplier" to mean any person who markets goods and services, whether for profit or otherwise (Section 5 (8) (b)). It includes producers, importers, distributors, and retailers. Suppliers of nano-enabled products would therefore qualify as suppliers in terms of the Act. The definition of "goods" includes "anything marketed for human consumption" (which includes nano foods) or any other tangible object" (Section1). This is wide enough to apply to nano-enabled products and related transactions.

From the definition of a consumer (as already set out in this paper), any person that purchases, consumes, uses, or concludes an agreement concerning nano-enabled products, as well as a person to whom such goods are marketed, will qualify as a consumer, and the CPA would be applicable to such nano supplier-customer transaction. The rights and duties of suppliers and consumers would therefore be determined by the contract relating to such transaction and will be supplements by consumer rights in terms of the CPA.

The Implications of Consumer Protection Legislation for Nanotechnology

The CPA sets out nine fundamental consumer rights, including the right to disclosure and information; the right to fair and responsible marketing; the right to fair and honest dealing, the right to fair, just, and reasonable terms and conditions; the right to fair value, good quality and safety. This section examines each of these provisions insofar as they may affect the nano industry and consumers. Since there is a lack of specifically created regulations that apply to them (Mitter and Hussey, 2019 and Berger, 2021), this analysis hopes to clarify, for both suppliers of NEPs and consumers, how it affects the transactions they conclude, as well as their rights and obligations.

Due to the low literacy levels of consumers in South Africa, suppliers have an obligation to draft contracts, marketing material and labels in a language that is understandable by consumers. Section 22 of the CPA compels suppliers to use "plain and understandable" language when providing product information (Reddy, 2012: 594; Lombard, 2020: 148). This right is also significant in terms of the disclosure of nano-enabled product information, particularly relating to what the product contains, as well as the possible health and other risks associated with its use. No specific exclusion is mentioned for nano-enabled products.

These obligations will apply in the case of marketing material and websites, as well as product labels, including those on nano-enabled products. The information on labels must be provided in "plain and understandable" language that is understandable by a person with "average literacy skills" and "with minimum experience as a consumer" (Section 22(1)). Hence, product labelling and trade descriptions must not be vague or misleading. Caution should be exercised with the use of "technical terms", which a person with "average literacy skills" may not understand. Where

nano-enabled products are concerned, such information should give a clear indication of what the product contains, particularly with food products or other products that the consumer will come into close contact with. For instance, by inhaling chemicals contained in the product. The present practices of indicating technical names of ingredients (for instance, Silver - Nano) or only the ingredient code allocated to it (for instance, E551) as ingredients on the label will need to be reviewed.

What if NEP contracts, marketing material or labels are not in plain language? The court in *Barkhuizen v Napier* (2007: Par 183) confirmed that, where the contract provisions are not in plain language or is worded in fine print, this does not make a contract substantively unfair, however, it may be significant when deciding on the fairness of enforcing a contract.

The Food, Cosmetics and Disinfectants Act (Republic of South Africa, 1972), authorizes the Minister of Health to publish relevant regulations. In terms of the Regulations Relating to Labelling and Advertising of Foods: Amendment (Republic of South Africa 2014: Government Gazette R. 429), suppliers must indicate all additives to food in the list of ingredients (Section 36) as well as all preservatives (Section 39). The nano-material content of food must comply with these provisions. However, there are no specific provisions on nano foods or the labelling requirements if the food contains NMs. Hence, labelling legislation should be amended to incorporate the labelling of these products and there should be mandatory labelling to firstly disclose that the product contains nanomaterial; secondly, to disclose the nanomaterial content (for instance, by indicating the name of the ingredient); and thirdly, by indicating the potential risks associated with such ingredients.

Section 55 of the CPA obliges suppliers to ensure that goods are "free of any defects". This would be applicable to nano-enabled products as well. The term "free of any defects" would mean that the supplier has an obligation to ensure that the nano-enabled product is safe and that it will not harm consumers. With the uncertainty in the behaviour of ENPs and ENMs and the minimal historical data available (Delgado, 2010), it would make it difficult for suppliers to give such assurance that products containing such particles and materials (i.e., NEPs) are safe. With nanotechnology, the challenge is not only the difficulty of proving the causal connection with consequent health effects (Walsh *et al*., 2008), but, being a new technology, it may take time for such adverse effects to manifest and be detected. In terms of Section 56, producers, importers, distributors, and retailers must warrant that these requirements and standards (set out in Section 55) have been complied with. In other words, they guarantee that the goods are free of any defects and reasonably fit for the purpose intended. As indicated above, the challenges inherent in NEPs will make it difficult for suppliers to prove that they are safe.

The Act provides for the development, adoption, and application of industry-wide codes of practice (Section 82). One of the purposes of such codes is to provide for alternative dispute resolution between consumers and the business sector. Such codes of practice provide for effective systems to receive consumer complaints regarding product failures, defects, or hazards, as well as injury and illnesses caused; and to identify previously undetected or unrecognised potential risks from such information. An industry code for nano-enabled products is needed to enable the abovementioned steps to take place. However, from the perspective of nanotechnology and NEPS, much of these measures are unattainable since there is a lack of historical data (Delgado, 2010) and because the associated risks are still being monitored.

Producers, importers, distributors, and retailers may be liable for harm caused by supply of unsafe goods or defects or hazards in any goods supplied. These parties may also be liable if they fail to provide adequate instructions or warnings about any hazards that could arise from the use of such goods (Section 61). The "strict liability" principle applies to the liability of such parties for injury/death, which means that liability is not dependent on negligence on the part of the producer, importer, distributor, or retailer. Claims for damages must be made within three years from the date of death or injury (Section 61). This may be quite complicated with nanotechnology

and NEPS as, firstly, there may be a lapse of time before the effects manifest; secondly, there is uncertainty as to the effects of these products; and thirdly, proving a causal connection with the NEP concerned would be difficult. For a consumer to succeed with a claim for damages, he/she will have to show a causal connection between the use of the NEP and the harm suffered. Although studies (Oberdorster *et al*., 2002, cited in Delgado, 2010) have listed damage to cells in animals as an effect, there is presently a lack of supporting scientific data to validate such claims where humans are concerned. The other challenge is that suppliers include exemption clauses absolving themselves from liability for damage. In *Naidoo v Birchwood Hotel* (2012: Par 53), the High Court refused to enforce an exemption clause since it would have been unjust and unfair. This has relevance for consumers using NEPs. Hence, even where standard form contracts indicate that suppliers are not liable for damage or harm caused by NEPs, in view of the decision in *Sasfin (Pty) Ltd v Beukes* (1989) where the court accepted that certain terms in a contract may be void where they lead to unfairness, it appears that protection of the consumer may be preferred over the principles of freedom and sanctity of contract.

There is also a duty on anyone who packages "hazardous or unsafe goods" to display a notice indicating such risks (Sections 22(1); 58(2)). For instance, the harmful effects of tobacco products must be clearly indicated on the packaging. The supplier has a duty to inform consumers where there is a risk attached to the product (Section 58; Reddy, 2020: 457). With respect to the disclosure of risks that the consumer could not possibly be aware of, in the decided case of *Mercurius Motors v Lopez* (2008: para 33), the Supreme Court of Appeal held that clauses exempting liability (with respect to risks), should be brought to the attention of the other party (Stoop, 2015: 1103). However, with nanotechnology, it may not be possible to state conclusively and explicitly what these risks and effects are. At some stage, an industry-wide code of practice would be necessary to regulate this.

Further, a "trade description", may not be used if it is likely to mislead the consumer (Section 24(2); Reddy, 2020: 455). With NEPs, not all consumers would be aware of the chemical names of ingredients and the risks associated with them. It may then be argued that compliance with the CPA provisions on product labelling and trade descriptions (Section 24) would be problematic. In *Standard Bank of South Africa Ltd v Dlamini* (2012), the court stated that, in terms of the law, the consumer has the right to be informed of material terms relating to the contract. Risks associated with a product would be one of such material terms which the consumer should be made aware of. The right to fair and honest dealing as far as NEPs are concerned, the consumer's right to "fair and honest dealing" (Sections 40 and 41; Lombard, 2020: 137-139) implies that there should be full disclosure of the nanomaterial used and how much the product contains (as a percentage of the product). This was demonstrated in a study by Thakur (2017), which indicates that a food product supplier used ingredients that were known to be harmful, viz. non-food grade Silica, in coffee and seasoning. These provisions prohibit suppliers from conveying false, misleading, or deceptive representations.

One of the purposes of the CPA is to "protect consumers from hazards to their well-being and safety" (Preamble). Any term or condition, including a product description or labelling, relating to nano-enabled products that threatens the well-being and safety of the consumer or limits or exempts the supplier from liability, is therefore prohibited. In enforcing these rights, the consumer may refer the matter to a tribunal or ombud or with the National Consumer Tribunal, which has the power to enforce criminal sanctions (Section 69). Failure to comply with the provisions of the CPA that protect the health and safety of the consumer could have serious consequences for the supplier in terms of penalties, including fines. The Commission may also issue a compliance notice (Section 100).

Conclusion

Nanotechnology has acquired global appeal. Its versatility in application and extraordinary characteristics has shown merit, especially to uplift disadvantaged areas (Delgado, 2010; ISO

12885, 2008). It will emerge as the favoured technology to meet future needs. Science and business should find ways of working together to embrace nanotechnology in a co-ordinated and unified approach, with equal responsibility and accountability. Clearly, the evidence available on the challenges associated with NMs and NEPs suggests that such material and products are not without risks and potential hazards for the consumer. More conclusive scientific evidence is required to understand these issues and adequately protect the consumer through explicit legislation and regulations. It is not acceptable that the size and shape of NMs should exclude them from regulation. Considering the challenges and potential risks and hazards presented by NMs and NEMs, there is certainly a need for regulation. In some instances, the implicit regulation by existing legislation and rules appears adequate to cover NMs and nano-enabled products. However, in other instances, there is a need for explicit provisions. Like many other countries, South Africa, has no explicit provisions pertaining to NMs and nano-products. This in no way implies that they are unregulated. Regulations and legislation pertaining to consumer products, in particular the CPA, generally are, in many instances, wide enough to apply to them.

This article has explored the various provisions of the CPA that would find application to NMs and nano-enabled products and which clearly create both obligations for business, as well as rights for consumers. It has been pointed out, for instance, that consumers have a right to the disclosure of information pertaining to hazards; that they are protected from terms and conditions that are unfair, unjust, or unreasonable; and that in the event of harm suffered, the principle of strict liability applies to the supplier. The uncertainty of the risks associated with nanotechnology and NEMs is primarily the reason for the gap in regulatory measures. The lack of such explicit measures specific to such technology and products does not imply that they are unregulated. The provisions of the CPA do have application in the areas pointed out with reference South Africa. There are certainly lessons for policymakers in countries introducing nanotechnology, particularly developing countries.

The inconclusive scientific evidence to demonstrate the effects of NEPs on the health of consumers means that certain provisions in terms of the CPA will have limited or little effect in protecting the consumer with respect to NEPs. However, in the interests of consumer and public safety, there is still a need to amend or expand existing legislation and regulations or introduce new rules, specifically to cover NMs and nano-enabled products. Noticeably, there are areas where explicit regulation is required and where government and regulatory bodies can play a role: there should be more transparency and information about the use and possible exposure to NMs used in products. Labelling legislation should be amended to incorporate the labelling of nano-enabled products. Labelling should be understandable to the average consumer and information on such labels must be presented in a way that is useful, particularly to consumers of below-average literacy. The use of "traffic lights" or colour-coded indication of risk would be useful. There should be legal consequences for failing to comply. There should also be mandatory labelling to show that a particular product contains NMs, they should be disclosed by name in an ingredients' list and risks associated with the product should be spelt out in "plain and understandable" language. A listing of the NMs allowed for use in food products and food contact materials is also needed and Information relating to NMs should be placed on a register, listing potential exposure and risks. An industry code for the nano industry is also required. Such code should provide for alternative dispute resolution between consumers and suppliers.

At an organisational level, for nanotechnology to reach its full potential, it must not be seen as the job of the scientist only. The various provisions of the CPA examined here indicate activities with a very strong business sense, particularly within the compliance and corporate governance ambit. From a nanotechnology perspective, for managers to truly embrace these activities, there should be open communication between scientists and managers of organisations dealing with ENMs, to understand their scientific implications in the business world. The various CPA provisions also show that there must be input from a multi-disciplinary and interdisciplinary approach by all departments in an organisation dealing with NEPs. Organisations should implement sector-

specific proficiency testing towards validation and standardising protocols regarding NEPs. This would serve as a stepping-stone towards establishing standard operating procedures, best practice, and uniformity of practice. This will better enable adherence to the CPA provisions. At a national level, there should be a connection with government and policymakers, regulators and researchers regarding the risks associated with and the use of ENMs. Thereafter, because nanotechnology is so dynamic, sector-specific committees and databases with respect to NEPs should be established and maintained. This should inform government, organisations, and scientists on the latest information so that the technology can be approached in an informed and unified way. Government/stakeholders should immediately embark on sensitization through consumer engagement, education, and awareness.

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