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Risk, Responsibility, Rights, Regulation and Representation in the Value Chain of Nano-products

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Abstract. This chapter reports on a research project which addresses one key question and a number of sub-questions. The key question is, what are the salient dimensions of the *commercialisation and governance* of nano-enabled products, covering regulation, risks, responsibilities, consumer rights, and representations to the consumer? The sub-question, and the particular focus of this paper is, how are nano-enabled products destined for consumer markets *labelled and marketed*? Within this more specifically, how do producers *perceive* and strategically target consumers, and *communicate* with them (or not) about the nano-component of their products? Then, does the way that consumers are conceived of and understood by different actors along the value chain *change* in terms of how the product is *marketed*? Finally, what are the ethical, governance and regulatory implications of the answers to these questions? The chapter builds on an ongoing collaborative project between SIFO (Norway's National Institute for Consumer Research) and the Manchester Institute of Innovation Research at Manchester Business School, UK. The work is a comparison of ethical aspects in the marketing of nano-products in Norway and the UK. This chapter provides preliminary findings and some reflections based on our empirical material; an analysis of web-based and other communications, interviews along the value chain ie with producers, importers, retailers and other 'intermediaries'; and eight group discussions across the two countries focussing on cosmetics and textiles.

Keywords. nano-enabled products, marketing, communications, labelling, cosmetics, textiles, governance, representation, responsibility, regulation, consumer rights, risk, ethics,

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Introduction: The Future is Now

Nanotechnology has been termed the Next Industrial Revolution, and is quite often referred to as something that belongs to the future; the next big thing [1].

But what such rhetoric seems to overlook is that there are many products on the consumer market enabled by nanotechnology already. Some of these are obviously using the term without reference to any technological component whatsoever, such as the small gifts dispensed in plastic containers called “NanoEggs”,

Indeed according to the inventory maintained by the Project on Emerging Nanotechnologies, there are at the time of writing (September 2008) 803 consumer products on the market, identified as such by the manufacturer. And new nano-products (so-called) are being released at the rate of three to four a week [2]. However, according to the Project’s director David Rejeski this figure is just the tip of the iceberg and the real number of consumer goods products incorporating nanotechnology could be much higher [3].

This trend resonates with the argument of McKibben and his general critique of Western consumerism, where he calls us to declare that ‘enough is enough’. Simply put, in terms of the rapid entry of new nano-enabled products onto consumer markets, he would charge that we already have ‘enough stuff’ [4]. This implies a moral and ethical imperative to curb the tendency to divert world resources into the production of, what we might call the ‘fluff and flippery’ of consumerism.

This point was echoed in the UK consumer groups which we undertook for this study. Across all four groups of younger/older; men/women who participated in the UK part of the research, informants were surprised at the pervasiveness of nanotechnologies now entering peoples’ everyday lives via the route of nano-enhanced products. Their surprise was at moments closely followed by irritation that previously acceptable ways and standards of doing everyday things (such as washing and polishing one’s car) needed nanotechnology interventions at all. This comment referred to the nano-enhanced car wax passed around in the group discussions. The product was considered frivolous, and probably more expensive than the antecedent versions.

The trend of rapid diffusion of nano-enabled products into consumer markets also raises the stakes for societies in terms of the need for consumers and consumer organisations to become directly engaged with the risk and responsibility dimensions of nano-enabled products as well as the need for greater social science research into the implications for societies of the rapid release of nano-enabled products onto consumer markets.

Most of the high hopes for nanotechnology concern the expected influence of this technology on important and urgent questions pertaining to environmental issues or hunger. But it seems that the nano-enabled products presently available and marketed as such in consumer markets fail to meet these visions. As of now, the products that we find on the consumer market that are marketed as incorporating nanotechnology, are mostly “luxury” products like anti-wrinkle face creams, all-weather jackets, anti-bacterial socks and super-strong, super-light tennis rackets. In addition they can be said to represent “incremental nanotechnology” [5], and appear more like modifications of earlier products, than revolutionary ones [6]. So, there is a rather striking discrepancy between the anticipated applications of nanotechnology that we usually hear of, and the actual and quite mundane applications entering consumer markets.

To take these products as objects of analysis might be a controversial exercise in itself. Some would claim that such studies detract from the high hopes and mightier application possibilities for nanotechnology. Studies of the currently available products on the consumer market may create and stimulate an atmosphere of “unnecessary” distrust in a coming desirable future which can still be brought about by the responsible and ethical development and commercialisation of nanotechnology. Some others have observed that such an application of ethics in the nanotechnology field, “nano-ethics”, currently appears more like a path-clearing exercise enabling the smooth development of nano-technology free from controversy than a genuine ethical reflection and on its’ future development [7].

1. How to Represent Nano- in Consumer Products?

From the consumers’ point of view, one relevant political point of entry is the consumer rights statement, formulated as a “Consumer Message” from President Kennedy to the US Congress in 1962 [8]. This seems very relevant to the development, launch and marketing of nano-products. According to this classical political document the main consumer rights in modern societies are: the right to choose; the right to information; the right to security and the right to be heard.

This brings us to the topic of this chapter. The theme is marketing of nano-products in consumer markets linked, from an ethical perspective to 1) consumer confidence and trust that products are released only after due regard to the safety, health, and environmental aspects of their availability in public domains 2) the control of the diffusion of innovations in risk societies and 3) basic and fundamental consumer rights to information which facilitates pro-active participation of consumers in public debates.

This set of concerns pervades this chapter, from philosophical, ethical, and very practical perspectives.

It has been suggested (and confirmed in our research) that some producers choose *to avoid* the nano-label, out of fear of provoking a regulatory (re)action or consumer ‘backlash’.. This begs the question, why would businesses seek to conceal some product properties and reveal or exaggerate others? And why might they seek to do so in the particular context of nano-enabled products?

And on the flip-side we should perhaps consider the marketing of products that do not comply with criteria that we might use to differentiate nano-enabled products, of scale, technological engineering and consequentially the emergence of new particle properties, but still are pro-actively marketed using the label ‘nano’, due to an idea that there are inherent advantages in marketing products as ‘nano’, even when they are not technically ‘nano’. An archetypal example of this is a recent car model from Tata Motors named Nano. The producers give a telling explanation of their choice of name: “*Why Nano? The name 'Nano' was chosen as it denotes high technology and small size*” [9]. Another interesting example is from the scientific institution NASA, which one would suspect of being quite conscious of nomenclature: in August 2008, NASA launched a mission including the satellite “NanoSail-D”. Here the term “nano” refers to

a class of satellites between 1 and 10 kilograms [10]. On the other hand this should not come as a surprise as the use of the “nano”-label is not regulated [11].

Such questions have been introduced in our interviews with manufacturers, importers and retailers of cosmetics and textiles products, and in this chapter we present some of our preliminary results.

In fact as we have reported elsewhere, we cannot take the label ‘nano’ on consumer products at face value.

‘The question of when the term... (nano) Is used has become particularly perplexing of late..... In this context the labelling (or not) of nano-artefacts as such becomes an object of study in itself. ...We must ask: What meaning and utility does the label have and what instrumentality does it bring, if any to stakeholders within the value chain; from scientists to marketers, from consumers and users to politicians and regulators? This is one practical way to unpack the situation that otherwise emerges as a patchwork of possibilities, where (1) the nano-label *is* used where the criteria set out (below) suggest it does *not* qualify (2) the nano-label is not used where the technologies incorporated appear to suggest it *does* qualify; and (3) the label is used, the nano-artefact qualifies as such and, moreover, the label is being pro-actively deployed and emblazoned across products and through marketing communications to denote product enhancement and improved performance’ [7]

To the above we could add examples which we found in the course of our present research where the term ‘nano’ is used to enhance a product’s *brand identity* by creating and standing in for attributes of scientific and technological superiority.

However if we are to qualify the above sufficiently to provide a systematic frame of reference within which to address the ‘is it/isn’t it Nano’ question, we must provide qualifying criteria for what we consider *is* a nano-enabled product, notwithstanding this is a research field which is notorious for its multiplicity of definitions and qualifying criteria. Indeed, helpfully the term Nanosciences and Nanotechnologies (N&N) has quite recently crystallised into a standard convention within the European Union regulatory sphere at least. And so we will follow this convention henceforth in this chapter [12]. Elsewhere [13] also we have settled on qualifying criteria for distinguishing N&N as:

1. dimensional scale (focussing on the nano-range of 1-100nm),
2. properties and behaviours of particles that come into affect when molecules attain a critical (small) size ie molecular disaggregation.,
3. system integration of nano-artefacts to make nanotechnologies and products.

Now we can return to our empirical story, whilst noting that in many of the contexts we discuss, the actors and authors we refer to are less specific on precise definitions either deliberately or unintentionally leaving the inclusive/exclusive question of ‘what is nano?’ open. Indeed offering reasons and explanation to account for this vagueness, and its regulatory implications, is one of the key objectives of our work.

An interesting question when it comes to consumer information or possibly labelling is the nano-component of the product *packaging* as opposed to the content of the product within the packaging. This is a field which needs greater attention in terms of social science research, and potentially regulatory attention [14]. New and improved functionality can be identified for packaging materials that could contribute to an increase in the shelf life of food, for example. But no-where, to our knowledge, is nano-enabled packaging labelled as such. Is this something that consumers should be aware of? or should they primarily pay attention to the product contents?

2. How to Regulate: Questions of Responsibility in the Value Chain of Nano-products?

There has been little co-ordinated international regulatory action on nano-particles and this sits uncomfortably with calls from some quarters for a moratorium on all research on nano-particles [15]. Further, disturbing is the finding that the proportion of individuals that believe risk will outweigh benefits *increases* after they learn more about nanotechnology [16]. Some consumers call for mandatory labelling when confronted with the fact that there are products incorporating nanotechnology already on the market in large numbers [6].

But the question of whether and how to regulate nano-enabled products has turned out to be a tough dilemma for regulatory authorities around the world. There have been several calls for greater scrutiny, a new regulatory framework, and arrangements for monitoring. Indeed, US regulators arrived at their first ruling in November 2006, on the use of silver ions in a Samsung washing machine, which some suspected would be the first ruling on nano-particles [17]. Interestingly in their final notice on this, however, the EPA does not actually address the new functionalities of the nano-enabled product. The machine was marketed with claims that it would kill bacteria, which would classify it as a pesticide in the agency's opinion, and it was therefore regulated under already existing pesticide controls [18]. The agency even specifies that: "The notice does not represent an action to regulate nanotechnology" [19].

The question here actually is whether nano-silver (silver-ions) really is different from silver in bulk form, in the sense that it requires new regulations. Similar controversies surround the labelling and regulation of other materials in the nano scale, such as the various nano-forms of carbon.

Further, it is important to stress that regulation as a notion can be understood as something broader than simply new legislative rules [20].

These two questions: how to represent and how to regulate are in fact interconnected. In an extreme scenario, if it were to come to a ban on all products incorporating nanotechnology such that existing nano-enabled products were taken off the market, there would be no representation dilemma in any case.. It is precisely because the responsibility for assessing and evaluating products is placed with the *consumer*, at the point of purchase, rather than by others in the value-chain (manufacturers, retailers, or indeed through regulatory intervention), that the representation and labelling questions come into the frame at all.

This positions the nano-products debate as part of wider debates around ‘consumer choice’, ie the devolving of the assessment of ‘what is safe and what is ethical?’ to the consumer, whether s/he wants this responsibility or not.

Alternatively a case might be made for mandatory labelling, like the example covering the traceability and labelling of GMOs in Europe in 2004 [21]. A similar debate rages in other areas of labelling such as carbon labelling/carbon foot-printing [22] or Fairtrade. A nano labelling scheme would regulate nano-technology through the vehicle of *informing* consumers and thus empowering them ‘to choose’. However the strategy of devolving responsibility to the ‘choosing customer’ through devices of information and labelling, assumes that the customer is able to negotiate their way through the plethora of ‘is it/isn’t it nano’ questions raised above, covering technical assessment as well as the different representation strategies of marketers. This, as we have said, has already created a situation of multiplex variety and contestation. It is difficult to see how, if all the other actors in the value chain of nano-enabled products contest the definitions of N&N and deploy the term ‘nano’ in a range of contexts, the consumer is somehow meant to ‘see clearly’ that which is not at all clear, or straightforward, to others.

Another labelling possibility is to incorporate labelling and marketing issues into “soft regulation” such as voluntary industry agreements, or Codes of Conduct whether generated by a territorially bounded administrative unit such as the European Unions Recommendations for a voluntary Code [23], or generated by actors in certain sectors; or by actors at a particular point in value chains, such as retailers [24]. This ‘soft’-governance option is getting a lot of attention from producers and regulatory authorities currently. It is, perhaps less helpfully, generating a plethora of Codes, and with them, potentially a great deal of confusion at all points of value chain, whilst paradoxically not yet entering consumers consciousness at all. Whether incorporating the issue of labels or not, it represents a governance strategy which places responsibility for the ‘soft’ governance of nano-enabled products, primarily with actors all along the value chain, rather than with consumers. It is a strategy which again poses problems in a consumer context: How can consumers (and indeed others in the value chain) understand what products, which sectors, and which geographical jurisdiction are covered by a particular Code and which are not?

Even for those studying this Code-creation process and the examples which are emerging across the globe (one might say the recent *proliferation* of voluntary Codes), it is not clear what the content, scope, and differences between the various Codes are, and indeed which have regulatory ‘teeth’ and which do not..

Then we could have a situation that is similar to what we have found to be the situation on today’s consumer market. That some producers explicitly promote and market as ‘nano’ some of their products which incorporate nanotechnology, be it “nanosomes” (e.g. face creams), “nanosilver” (e.g. socks), “carbon nanotubes” (e.g. tennis rackets). Others participate in working out voluntary labelling and standards schemes, like The Blue Sign for textiles. A number of other producers do not inform consumers that they market products incorporating nanotechnology, not necessarily by hiding it actively, but neither telling it openly. They may boast of properties though, that we would identify as coming from nanotechnology, without saying or claiming it to be a result of that, like “vectors” in cosmetics.

Most studies have found that consumers are quite unknowing of nano or nanotechnology [16], [25], [26], and as such it was of little surprise that they were

unaware that there already are products with nanotechnology on the market [6]. On the other hand, in one of the UK group discussions commissioned for this study (older men) informants *were* aware of the existence and availability of nano-enabled products in consumer markets *per se*, but they were unaware and surprised by the quantity,, pervasiveness and '*silent creep*' of 'nano' into products.

This point is developed further by our research team reporting elsewhere on the nano-marketing and labelling strategies of producers and retailers [27]. There, we reflect on the finding that in the marketing of nano-enabled textiles and garments, for example, items are branded for sale not as nano-enabled products according to some technical nano- specification, but rather in terms of the new *functional* attributes which the nano-technology brings into being. This becomes the basis of the appeal to the consumer, and also the rationale for charging a (significantly higher) premium price. Ultimately it is a marketing strategy which seeks to create/sustain a market niche/foothold by differentiating the nano-enabled variant from its own antecedents: an appeal which is coupled with the claim to be maintaining a position of innovation-based leadership by improving incrementally upon an antecedent variant (classic incremental innovation), at the same time claiming leadership over competitive products.

What is interesting and novel in our finding is the way in which the new attribute is *explicitly* communicated through the label in terms of enhanced *functionality* (crease-resistance, stain-resistance, water-proofing in textiles, anti-wrinkle in cosmetics) where the new/improved functionality becomes the key to connecting the technically complex field of nano-technology to the practical task of appealing to the customer. Indeed, more technical appeals related to the actual nano-science/technology specification which explicitly use the prefix 'nano' appear to be *on the decline*, and being replaced by function-related prefixes. This again has implications for regulation and the responsible development of nano-technologies because the nano-specification which sits behind the claim of *enhanced functionality* is all but hidden from the sight of the consumer.

This strategy demonstrates the co-coupling of perceived product enhancement, with perceived customer benefit, via the strategic intermediation of a nano-label. The intentional removal of the nano- prefix from the promotional mix and message, and its replacement with another label which maintains product-enhancing appeals whilst intentionally omitting the nano-part of the label is a key finding of our research. It is also evidence of the still very fluid and unsettled nature of the nano-labelling phenomenon, in the very construction and performance of 'what is nano?'.

How to represent nano in consumer products would certainly also be a reflection of regulatory issues: if mandatory schemes are imposed, little room for consideration is left to producers whilst at the other end of the spectrum, voluntary schemes are dependent on business co-operation, in that business is given at least some part in the formulation of rules and working out the framework for such arrangements.

The current market conditions, as we see them, offer different roles to producers. The motives for those that choose not to market the nano- aspects of their products, could at least be two: they see no benefit in doing so, maybe only a downside. Or, they might fear that actively telling the market that they use nanotechnology of some kind in some way in their product, could "provoke" regulatory action. This last motive may of course also be the justification for joining one of the current voluntary labelling schemes: signalling to the regulatory bodies that they are responsible and trustworthy

actors that can be relied on to make adequate framework, without the need for initiative and resources from governmental bodies.

This last point, where stakeholders themselves take the initiative, is something that fits well into the transition from Government to Governance. This is part of a rationale which not only passively permits, but *actively desires* the inclusion of the full range of stakeholders in the political process (including public deliberation and public engagement exercises), and is an important element of the debate on ‘how to govern,?’ in an ethical as well as a practical sense. The traditional “command and control” mode of governmental bodies in regulation is complemented or augmented by governance processes, where all those that are involved in the scientific and commercial production, distribution, and consumption of goods or services that are to be regulated, are invited to participate actively in laying down the framework and conditions for such regulations.

Regulatory agencies around the world are grappling with how to handle nanotechnology: can nano-particles of silver be considered to have such new properties that it should be considered a new element, or are the regulations concerning silver in bulk still appropriate?

The new chemicals regulation scheme for Europe, REACH (Regulation for Registration, Evaluation, Authorization and Restriction of Chemicals) is a comprehensive one. There have been questions whether and how nano-particles will fall under its scope. According to European Chemicals Agency, they do, but it is the potential registrants that should consider whether they have obligations under this new regulation. Interestingly, they take into account future development of the knowledge on nano-particles: “The evolving science of nanotechnology may necessitate further requirements in the future to reflect the particular properties of nano particles” [28]. Under REACH all forms of carbon were at first exempted from testing, which in hindsight was rather striking as nanoscale forms of carbon are among the best known nanomaterials, like carbon nanotubes or buckminsterfullerenes (“Buckyballs”). This was recently amended (June 2008) by representatives of the EU governments. Following final EU approval, it is expected to go into effect within three months [29].

3. Comparing Norway/UK Consumer Markets for Nano-products: Research Method and Materials

At the time of the Rovigo conference where our project was first reported (May 2008) the primary fieldwork which informs this chapter had not yet been completed. At the time of writing this chapter (September 2008), the fieldwork had been completed but had not yet been fully or systematically analysed.

Below, we provide an overview of the research design and methods, with reasons for choosing the design we did. We promise no more in this chapter than to preview the study-outputs in terms describing the primary data gathered and some preliminary key findings which provides the material for some reflections and conclusions in terms of some governance implications for all those classes of agent (value chain actors, intermediaries and NGOs, consumers, policy makers and regulators) involved in the commercial exploitation and marketing of nano-enabled products, and their regulation. A full analysis and reporting of the empirical study remains for a future date.

We hypothesised at the outset that the markets for nano-based products is rather different in the two countries, and mobilised the two research centres to undertake a preliminary investigation as to whether indeed this is the case. Our starting point for suggesting national differences between Norway and the UK is that there has been a lively debate on nano-technology in Great Britain, partly as a result of Prince Charles' very visible concern, which in part prompted the high profile report of The Royal Society report in 2004. In Norway, by contrast there have been few traces of such a public discourse. (Although it should be noted that the Research Council of Norway actually were quite early in their focus on ELSA-issues when they issued a report on the national needs on research and competence in this field in 2005 [30]).

In addition, we suspect that citizens' trust in regulatory institutions is higher in Norway than in the UK [31].

The underlying study was carried out in Norway and UK, as cooperation between SIFO and the University of Manchester. We focus on two product groups: cosmetics and textiles. That choice was made mainly on the basis of product availability; i.e. where market entry is evidenced by products 'on the shelves of retailers', so to speak, and partly as a result of observations in an earlier project, where we found that perceived risk and ethical considerations increased as the products in question got closer to the body/skin [6].

This 'emergence' of nano-enabled products through value chains, on to markets, and into the everyday lives of consumers, is recognised as under-researched [13]. To an increasing extent the development of nano-technology has become an ethical and social issue [32] as much as a question of the generation and production of new scientific and technological knowledge *per se* attached to potentials for application and commercial exploitation. Many of the ethical and social issues are general questions on the relationship between science and society [13]. However, some of them have special relevance for nanotechnology. Nanotechnologies are enabling technologies, meaning that they are a means to achieve different ends for different products and applications. At this point we must recall the point made by Wood et al. and others that a key reason as to why nanotechnologies differ from antecedent waves of technological development is that nanotechnologies are not, and should not be conceived of as an 'it' [33].

Rather, and most importantly, we are witnessing the emergence and crystallisation of a new technological 'platform' or scientific paradigm, involving fundamentally new scientific method and procedure from which common start point is generated a plethora of new scientific breakthroughs and applications impacting on the full range of material artefacts, sectors, and applications. This implies that nanotechnologies may be implemented on an exceptionally broad scale ranging from energy and medicine to water purification and materials science and technology. And it is this huge variety of potential applications, as well as the variety of actual products entering markets, juxtaposed with still unresolved questions of safety and hazard, in scale and type, which create the conditions for the governance of nanotechnology as warranting the title 'unprecedented'. It is also these features which must inform and drive our choice of social science *research design*.

Our present paper is based on findings in three stages of our comparative empirical research:

- Content analysis of advertisements, packaging and labels in the UK and Norway for cosmetics and textiles.
- Qualitative in-depth face to face and telephone interviews with producers, importers and retailers in the two countries for cosmetics and textiles.
- Qualitative group discussions with the general public (excluding people who worked directly in the fields of natural and physical sciences at a University (graduate) or above (postgraduate) level. Four group discussions were conducted in each country, ie younger/older female groups and younger/older male groups.

The producer communications are mainly from the internet, and are saved as 'screen-dumps' or print-out from various actors: producers, innovators, importers, magazines and retail. These are supplemented by in-store point of sale (product labels and display) materials. The first part of the project was to get some insight in the two markets of textiles and cosmetics. To do this we turned to the marketing of their products, chiefly on the net, and looked for nanoproducts on different pages. Which internet pages we visited, and subsequently which entities we turned to for interviews, were based on both commercials and news stories in magazines and newspapers and results from search engines on the web. In addition, we have used leads from the online consumer product inventory of the Woodrow Wilson Centre. We focussed on actors we saw as central, and that we found used "nano" more or less openly. The webpages of the brand Lancôme became central for the study of cosmetics since in their widely sold Revitalift-series, they, on the front of the packaging announce the use of nano-ingredients. We found the information available on the different country-focussed webpages of Lancôme varied, which made these webpages an interesting study in themselves. That said, we also visited the web-pages of all other major cosmetics brands and of textiles and garment producers, from science-origators through to technology developers, component manufacture and processors, branded-goods manufacturers and various marketing and distribution channels, from direct marketing on the web through to various types of shop outlets. Industry Associations, and consumer 'intermediary' organisations were also interviewed.

We have undertaken interviews with different actors in the value chain of the two product categories. Seventeen interviews have been conducted (12 on textiles and 5 on cosmetics). Interviewees were first contacted by email, and followed up by telephone and face to face conversations. We used a semi-structured interview guide, and the interviews were taped where permission was given by the interviewee. The interview started quite broadly with questions on the interviewee's background and the company's philosophy. We then turned to questions about innovation, novelty, and technological development of their nano-enhanced products. At this time we focussed the discussion on nanotechnologies: what they knew, and if they had any nano-products in their product portfolio. There followed questions on the profile and perceptions of consumers: who they understood to be buying their nano-products, customer trends., and questions on how they perceived or 'constructed' through mental-models, their 'nano-consumer'. We turned to regulatory and governance affairs exploring the interviewees views on the distribution of risks and responsibility for regulating nano- in the value chain, questions on consumer rights and regulatory affairs and finally we asked them to comment on the (5-10 years) future of each of these issues in turn.

It should be noted here that some actors have been rather unwilling to participate in interviews, both because of stated time constraints, but also due to some scepticism

towards the motivation for this project: that our project was more of the sensationalist looking-for-scandals kind of work, and why would be at all interested in this or why it would indeed be more interesting to talk about more sensitive issues. That said, we have also talked to several actors in the field who had few objections of this kind, and happily participated in the interviews.

All interviewees were assured of anonymity. For this reason no reference to individuals is provided in this chapter nor can individuals be identified as working for any particular organisation mentioned in the text.

In this chapter we focus on the interview material collected. In other articles we pay more attention to producer-communications through the lens of web-communication and actual labels in use [27].

4. Discussion of Findings

The preliminary findings we present below relate to regulatory/governance and marketing/labelling issues as they were revealed in our data and primary research.

4.1. The Rapid Emergence of Voluntary Self-regulation: Codes, Standards and Accreditation Regimes in Textiles.

In the textile sector we identified and captured views on two UK industry-led emergent voluntary standard schemes and four European (including German/Swiss) ones. They were:

- Responsible Nanocode, developed by the industry group NIA in the UK (comprising major trans-national corporations from across the value chain, including retailers). The developers of this code are reviewing the implications that have arisen from a comprehensive international consultation on the code.
- A BSI standard is currently in development by the UK network Nanocentral. Its aim is compatibility with a suite of BSI standards and their compliance regimes.
- Bluesign is a currently existing European voluntary standard aimed at gaining industry confidence in production processes, storage and transit (in particular in terms of worker safety) of textiles, tracing throughout the supply chain up to the point of the end-consumer. It is not concerned with post-use disposal.
- Hohenstein Institute in Germany creators of Hohenstein Quality Label for nano-enabled textiles (Nanolabel)
- The Swiss Retailers Code.
- The voluntary EU Responsible Nano-Code, launched in February 2008

All of these Codes and Standards regimes either directly involve or will have implications for product labelling. In our study business representation organisations and business interviewees stressed that their intention in formulating and signing-up to the Codes and Standards regimes is to demonstrate and participate in a process wherein

the nanotechnology component of the product and production process are being managed pro-actively in a 'responsible' way. Importantly, all of these schemes have emerged from *industry co-operation*, collaboration, and mobilisation on behalf of businesses in general, and involve businesses at all points of the value chain. In general the response sits out-with competitive relations, unless couched in terms of *striving to differentiate and communicate to customers* ethical good practice described in terms of following the highest possible standards of safety within existing knowledge on hazards and risk from (quote) '*the cowboys*' who get away with not committing the costs and investment needed to match these high standards. The intent is to 'drive out' the so-called cowboys from the field. Importantly, the early and exploratory development of such codes and standards is a collective rather than an individual endeavour, and is motivated by a collective desire to develop nano-technologies with due regard to safety (especially labour force safety) rather than as an outcome of defensive or passive response to 'regulatory-push'. Typically the initiatives have involved multiple actors from the business, regulatory authorities, public institutes and NGO spheres.

This chimes with the view of Lee and Jose, who say that given the rapid development and commercialisation of nanotechnologies, businesses are in a unique position, in terms of a capability to match governance requirements to the rapid emergence of N&N and its regulatory implications. Given the asymmetries of resources and knowledge between large business, governments, NGOs and other citizen-representation organisations, businesses must/should, they argue, play a key role in 'rapid response' strategies founded on notions of 'corporate responsibility' and guardianship, rather than looking narrowly and solely at short-term concerns such as market exploitation and profit maximisation [34].

Although such industry-led self-regulation can be interpreted in some respects as a way of pro-actively trying to pre-empt anticipated regulation; in general terms our interviewees, especially those from, German or Swiss contexts where 'responsible capitalism' was considered a cultural legacy embraced in the training of engineers; spoke of their commitment to a high standard of care which embraced guardianship of employees, the general public, and natural environments. They took this responsibility very seriously as an underpinning fundamental principle of 'how to do business'. (These respondents were either selling into or had some other relevance to UK consumer markets hence they were included in our study). They stressed that they were motivated by due diligence in NOT taking unnecessary risks (within existing knowledge, hence embracing the 'precautionary principle' wherever scientific knowledge on safety and toxicity was lacking) with the wellbeing of people and natural environments their primary motivator. It was noted that current codes dealt reasonably well with the health and safety of *people* (the result of antecedent strong controls on health and safety at work) but lagged in terms the well-being of natural environment, in particular issues of recycling and environmental impacts of textiles incorporating nano-chemistry into manufacturing processes. This appears to represent a significant and important 'gap' in current industry self-regulation codes. Voluntary codes are worthy of significant research attention in order to capture and undertake comparative analysis of the origins, development, content, scope and regulatory teeth of existing codes.

However in interviews with informants from other country/business sector contexts, this heightened 'standard of care' was in contrast, not only ignored, but

appeared to be proactively avoided if not flouted or resisted by some interviewees. It was not difficult to find examples of accounts (one from the US, one from South Asia) where such ethics of responsibility were not in evidence at all. In one case; the need to remain 'competitive' in the face of global and local competition was deemed the overriding concern, matched by a tendency to resist external regulatory pressure. For another respondent (a South Asian, small distributor of finished textiles) action appeared to be motivated by a need to assist importers from developing countries to develop their small and family owned businesses in the face of the dominance of large multi-national, predominately Western corporations. Further the informant noted the prohibitively high cost to small importers of registering for regulatory certification. These arguments were cited as the main reasons why s/he proactively avoided both government and voluntary industry-led regulation. It would appear that only obligatory regulation would have a bearing on the actions of informants such as this small importer/distributor.

What is also clear is that the proliferation of 'bottom up' voluntary schemes will require a process of further rationalisation of voluntary initiatives to a single or clearly differentiated smaller number of codes and industry standards regimes. It is as yet unclear how this process will unfold. In each case the aim of the framework is to differentiate those products and processes which carry the endorsement and accreditation of the standard from those potentially 'lower standard' products/businesses which don't. In this sense accreditation marques become a marketing tool as much as a notation of guarantee of performance or safety standard. It can be viewed as a marketing tool as it signals that the actor in question proactively wishes to be associated with a safety/wellbeing standard. And to the extent that consumers may or may not be aware of the details of the standard: its scope, content, and measurable indicators for the achievement of certain performance criteria; it can nevertheless, in time, contribute (according to one interviewee) to the creation of consumer 'trust'.

The use of accreditation schemes and standards to engender trust, however needs also to be positioned against the replies from one small retailer in the specialist (outdoor sports) context where it was noted that the reputation of the brand, trumped individual technology enhancements in terms of 'standing in for' quality and assurance in terms of customer trust in the product. Of course the accreditation versus brands dimension is not mutually exclusive, as one might expect those brands considered superior in terms of quality and reputation, also tend to carry (or indeed drive forwards) industry accreditation schemes and marks.

4.2. Existing Regulation, the Marketing of Science, and the Science of Marketing in Cosmetics.

In contrast in the cosmetics sector we did not come across any such initiatives for voluntary schemes. This could be related to the fact that cosmetics are highly regulated at the industry level already. There are for instance national Norwegian regulations which are not fully aligned with the European directives (as the legislation on medicines is not), and first and foremost the producers refer and defer to the relevant national regulations. The new regulations of chemicals on the European market,

REACH (Regulation for Registration, Evaluation, Authorisation and Restriction of Chemicals) entered into force in June last year [28]. The representative from the cosmetic manufacturers who we interviewed reported that in his view, the REACH regulations in general, and the national cosmetic regulations in specific together cover the issue of nanotechnology in a satisfactory manner: there is subsequently no need for separate regulations of this technology.

The cosmetics regulations also concern how far into the skin cosmetic products are allowed to move, said one of our interviewees. When new products are placed on the European market they are to be assessed by scientific assessors, who according to one of our sources, are supposedly very strict. The latter source also pointed out that the industry would not want the ingredients of their products to penetrate the skin completely – this was not considered desirable for both safety and effectiveness reasons. The industry's aim is to have the active ingredients stay in the skin and have effect there, not entering the bloodstream and moving away from where they are supposed to work.

Some cosmetics producers use the nano-term openly and actively in the marketing of their products. This seems to be simply a single example of a wider a distinctive “tradition”, practice or tendency in the cosmetics business to use scientific language *as* marketing strategy, turning it into a fine-art in the creation and deployment of quasi-scientific terms.

Examples of this include: “Enriched with Pro-Retinol A and Pro-Tensium, the formula is specially developed to reduce the appearance of wrinkles and leave skin feeling immediately tautened” [35] or, “Vectorized Vitamin C, Siegesbeckia, high-potency anti-oxidants like NDGA and proven anti-irritants help boost and maintain skin's natural production of collagen and elastin...”[36] and “Dior Innovation centre selected an exclusive Dior bio-technological extract, Centuline™, to promote the action of this “longevity protein” at the cutaneous level” [37].

This use of quasi-scientific terminology was the object of some irritation among different actors within different functions of one large multi-national cosmetics business. Here, senior scientific personnel expressed irritation that their own marketing department routinely use quasi-scientific language in order to niche-market their products to support premium pricing strategies. In some cases retailers of cosmetics shared this view. However the use of very technical scientific language in the marketing of key cosmetics brands does appear to ‘work’ in commercial terms, as many brands which use these techniques extensively in their magazine, television packaging communications are commercial successes in terms of sales volumes.

On the other hand, from the point of view of ‘identifying nano’ through product information and labelling, our study suggests this would be difficult if not impossible in this particular sector. The likelihood that consumers could play a part in a system of ‘vigilant governance’ in a case-area where a ‘continual stream’ of supposedly revolutionary cosmetics is a key feature is unlikely in our view. The case of cosmetics highlights problems in the notion that consumers can play a role in the governance of nano- by picking up on marketing and labelling, either to ‘police’ the field or alternatively to have an influence through improved trust and confidence in influencing labelling and customer information campaigns in a certain direction.

What distinguishes cosmetics is the existence of highly sophisticated marketing and brand-differentiation strategies premised on the use of highly technical quasi-scientific language to the extent that discerning the difference between the provision of

information about genuinely new *technical advancements*, and the deployment of *scientific language* in the *marketing* of this entire class of cosmetics is so blurred as to be indiscernible and confusing. The indistinctiveness of the boundary between the science itself, the science of marketing, and the marketing of science, adds up to such a confusing cocktail, that this is an area where it would be particularly difficult to imagine regulation through labelling playing a role in nano-governance.

Another of our foci in this project has been to identify the nano-compounds used in products by systematic analysis of packaging and advertising communications, and their nanoproperties ie how nano-makes a difference to functionality. One of the most high-profiled nanoproducts in the cosmetics industry, is the Revitalift range marketed by L’Oreal. Here the nanocompound is nanosomes, small bags containing the active ingredients to help them get transported to where they are needed in the skin. Effective transport of active ingredients would be such a property. (This property is also stressed by two of our interviewees). Another well-known cosmetics producer is Estée Lauder. They do not use nano-terms in their marketing, but rather talk of “interactive delivery agents called Cell Vectors. Their mission, as they report, is to recognise where an active agent is needed, and to get it there quickly so as to help re-ignite the skin’s natural age-fighting ability” [38].

4.3. Industry Structure, Multinational Reach, and Consequential Nano-governance Issues in Cosmetics

There has been substantial merger and acquisition activity in the cosmetics business over the years. An interesting example in this respect is L’Oréal that is the owner of 26 international brands, among them Lancôme, Biotherm and Body Shop [39] Each of these brands has different profiles and holds different brand niches within cosmetics markets. From this, it seems rather unlikely that any of these brands publicly would raise their voice against nanotechnology, at least in the current situation of apparent lack of rigorous scientific support for a more sceptic stance on the use of these technologies in cosmetics.

One firm, owned by L’Oreal, is Lancôme. Going through the web pages of Lancôme we find important differences in products that are identified as using nanotechnology for example when we compare the US webpages, to those of their European counterparts. The French pages for instance seem to have a better liking for the term “micro” over “nano” in the description of identical or similar products. An example being the Lancome Hydra Zen Skin De-stressing cream (In French: Hydra Zen Neurocalm Soin Hydrant Apaisant Anti-Stress). At the French page: “Les micro-capsules de Lipidure et d’acide Hyaluronique, les céramides vectorisées et le Glycérol...” [40], while at the American page this is described as :Combining Acticalm2™, Biolactone™ and nano-encapsulated Triceramides, ...”[41].

This suggests in terms of the policing or monitoring of the labelling and product information dimensions of nano-governance, this may prove difficult to the point of breakdown when we consider all the world-wide communications of all the nano-compounds and the consumer products into which they have, and will increasingly, incorporated.

In one sense this is a rather surprising finding for Lancome that differential marketing and product information is given across its country-based websites, given their premise of equal products in both regions. However it does indicate differentiated marketing of the same products in different parts of the globe, reacting to the marketers' understandings of different local conditions and perceived (or researched) differences in how nano- might be 'received' or alternatively 'resisted' in different country contexts. For example: it is claimed that the Americans like the idea of risk more than comfortable Europeans do [42] and this may play out in differentiated marketing campaigns. A second interpretation might be historical, pertaining to different legacies left by previous controversies which differentially impacted upon, and were differentially responded to, by regulatory organisations in different countries, leaving contextually different patchworks in terms of consumer trust and confidence. An example might be scepticism towards Genetically-Modified food among European consumers compared to Americans.

Interestingly, lately there have been indications on that Americans are turning more sceptical: in a study performed by UW-Madison Survey Centre during the summer of 2007 [43] on a sample of 1,015 adult Americans, only 29.5 percent of respondents agreed that nanotechnology was morally acceptable. The corresponding number in European countries were found to be 54.1 percent in the UK, in Germany 62.7 percent and in France 72.1 percent of survey respondents saw no problems with the technology.

The finding that different nano-communications were used in different countries, whether premised upon consumer differences or the strategies of producers was confirmed in our talks with American players in textiles. The incorporation of nanotechnology by American companies has been evident for many years and they have been traditionally very open, even boosterist about their use of nanotechnology applications. On the other hand are they appear more cautious about talking openly about the topic of nano-regulation, on the twin grounds of competitive sensitivities and the potential for litigation. The latter was also witnessed when recalling a previous (British) nano-controversy over labelling where American respondents indicated their caution over liability issues, citing the antecedent British case.

5. Theoretical Reflections: Who Will Take the Hot Potato?

Our brief theoretical reflection considers the wider significance of the empirical story set out above. It is driven by a single theoretical and practical puzzle:

'What model of distributed governance maps most appropriately onto the distributed nature of innovation, and notions of distributed responsibility in the commercialisation and marketing of N&N?'

A useful entry point is provided by a reprise of Beck's Risk Society. In Beck's terms, an increasing industrial division and specialisation of expert labour combines with the tendency of science to progress from discovery to large-scale in-situ technical application. Such tendencies accompanied, indeed caused the onset of processes which characterised the Western world of late 20th century; an epoch he referred to as late-

modernity. At the very time that the privileging of scientific knowledge and scientific method heightened the risks, nature, scale, and potential for (unknown and unknowable) negative and unanticipated outcomes or industrial-scale ‘accidents’, these processes were themselves creating the conditions of risk-laid-bare, and with it possibilities of imminent large-scale catastrophe, affecting the many and not the few, and reaching geographically well beyond the territorial jurisdiction of the agents responsible for it. This for Beck represented a break with history. The five co-constitutive trends that we can identify are: an increasing division of expert labour; the need for policy to re-connect and organise the interdependent system parts; the difficulties notwithstanding of overseeing and co-ordinating the entire system; the repercussions in terms of creating a world of heightened exposure to technical catastrophe; and ultimately, heightened probabilities of experiencing and then having to deal with the *science as it goes wrong*. These co-constitutive features lay at the heart of Beck’s central thesis [44].

And cue the resulting, central, governance problem. As loosely connected and relatively autonomous, but *interdependent* systems of agents and expert labour groups enlarge (Beck mentions the agents of modernisation : business, agriculture, law, politics); then new methods and modes of co-ordinating and re-integrated such a distributed system of agents and distributed knowledge must be pro-actively sought. The technical exploitation of scientific discovery under conditions of uncertainty now requires a corresponding effort to govern, regulate, and attempt to manage the inherent risks of this process which we might call the practical exploitation and application of scientific discovery. And responsibility for dealing with the negative outcomes and consequences of this process passes into the realm of monetary instruments and institution, such as *ex-post* financial compensation, rather than being taken up by any other more ethics-based governance mechanisms, such as prudence. Key questions for social actors, such as how to organise the *distribution* of risks, regulation, responsibilities, and human rights, come into play. With reference to different agent groups – authorities, science and politics , Beck asks the thorny question:

‘Who will take the hot potato?’ [44]

Now if we step away from Beck we can re-enter the same debate but from the point of view of more recent literature in the field of innovation studies. Here the object of research is less a critique of science from the point of view of *risks to society*, rather the innovation studies literature provides the flip-side of the coin - a concern to understand the knowledge and innovation process in order to better *encourage* the development of new scientific knowledge and its take-up through technological innovations, markets and economies. Nevertheless a complementary set of organisational features and dynamics to that provided by Beck can be seen. The basic idea in juxtaposing these two literatures is to demonstrate how policy concerned with the *protection* of societies from the unanticipated consequences of the exploitation of science; has a flip-side in both policy and normative terms, which stems from the view that coalitions of actors form around science and technology projects in order to *drive forward* technological innovation into markets, primarily for the purpose of *economic* gain. Of course that isn’t always the case, and it may be that certain governance regimes are able to *combine* these two objectives simultaneously (for example providing monetary incentives to channel Science and its user communities into life-

enhancing drugs, solar energy, water purification applications) etc. Science and technology is therefore governed from two, conflicting but potentially synergetic directions. The first is concerned with risks and returns to society as a whole, the second concerned to encourage the generation of science and technology as a down-the-line contribution to economic growth. A potential 'third way' is to incentivise the development of science and technology *towards* health and sustainability applications [13].

We can begin by noting that the model of the 'lone scientist' generating basic science in a linear fashion starting from first principles (so called *Gibbons et al* Mode 1 science) [45] is now countered by the view that scientific discovery following a Mode 2 practice, not only exists but arguably has a stronger foothold on scientific practice than does Mode 1. Under Mode 2, scientists work in teams, often in a cross-disciplinary (or some would say inter-disciplinary way) and the discovery process begins from the articulation of a *problem* to be solved by the team rather than a building-up of scientific knowledge from first principles. This theory tends to focus on the integration of different capabilities and strengths of different scientists, integrated through team effort. Within such a team, 'users' of the research may be included (an example in Manchester is University scientists collaborating with and co-authoring publications with personnel from the Christies Cancer Hospital for example). In this case, it seems more likely that the field is orientated around an applied problem – the discovery of cancer treatment drugs – rather than knowledge for its own sake.

Moving on, the literature continues in this direction by taking a more explicit *systems perspective*. First the so-called triple-helix model [46] considers that science progresses through arrangements which bring together the Nation State, academia, and industry –again opening potential for the scientific search strategy to be influenced by others beyond the narrow confines of academia/academic scientific research, where the State and public funds play a role in guiding scientific research and discovery in particular directions perceived as 'desirable'. Finally, notions of open innovation systems and distributed innovation processes [47], conceptually and practically require attention to a new idea, that of *distributed governance* [48], where governance models are required which map onto the enlarged idea of systemic and multi-actor frameworks for the co-ordination, organisation, and regulation of the process of scientific discovery and its exploitation. To be sure, in contrast to Beck's analysis, the debunking of the idea of the isolated and lone scientists in favour of 'group science' which involves *governance agents themselves*, indeed, scientists *as* governing agents provides a very different model of a more collective and collaborative effort than is depicted in the us-and-them framing of Risk Society.

6. Conclusions and Regulatory Implications

Our research among consumers confirmed the findings of many other studies reporting low levels of awareness and knowledge of N&N, in scientific and technical terms. Added to this, we found consumers to be surprised, and in some instances irritated by the extent to which nanotechnologies have become a constitutive feature of mundane, everyday products. N&N is not, therefore about some blue sky future, an out-there 'revolution', a topic for abstract reflection. Rather it is, in terms of how

consumers are *actually* likely to encounter it, about the pervasive yet invisible creep of nano-technologies into peoples everyday lives.

Producers are still experimenting with the marketing of products containing nano-technologies, creating a patchwork quilt of variety in terms of marketing communications. In some cases the prefix 'nano' is used as a positive marketing device, standing in for other brand or product characteristics such as enhanced product functionality and/or advanced technical specification.

Moreover this is a dynamic situation, with some producers explicitly *retracting* the nano- prefix. Far from denoting positive attributes there are fears that the nano- label may bring products into a regulatory gaze that could otherwise be avoided, and open to consumer scrutiny which might otherwise be side-stepped. Indeed the explicit use of the term leaves the producer exposed in the event of a consumer backlash against N&N. Some foresaw an increase in this tendency to intentionally remove any reference to nano-.

Other producers make the N&N component of their products so lacking in visibility that only the very knowledgeable chemist, inspecting the ingredients list or technical specification of a product can spot the nano- in the nano-enabled product. Even then the presence of a particular ingredient or chemical compound does not reveal crucial information about the scale-range at which it is being used in order to exploit particular properties, nor the chemical process by which the product was manufactured. The *nano-ness* of the product is all but invisible. The rejoinder from producers on this point however is often that, strictly, nano-enabled processes, such as pasteurisation, have been used for centuries without the label nano- and it would be ridiculous for regulators to begin insisting on the nano- description now. Moreover, cosmetics manufacturers were found to be using different marketing terminology and product descriptions in different countries.

Needless to say this plethora of different marketing communications – across product groups, individual products and countries, coupled with the fact that it is an ever-changing picture, suggests that this would be a minefield to 'regulate' from the perspective of monitoring producer communications. And from the perspective of consumers, it is difficult to envisage how they can take on a role of 'vigilance' in the policing of nano-products in the absence of any standardisation of product information and marketing communications. Until then, consumer contact with N&N is more likely to be via individual 'scares' and controversies communicated through the popular media, such as the controversial use of titanium dioxide in sun-creams.

Furthermore, in the case of retailers, early findings suggest a very low level awareness either of the science of nano, or of how it is used and incorporated into the products retailers sell. Where responsibility was allocated by retailers, it was handed firmly back to manufacturers. An important exception to this is provided by the Swiss Retailers Code where responsibility for surveillance, vigilance, transparency and monitoring of the whole supply chain for nano-enabled products is bravely taken on by the retail sector.

A key point which our research has highlighted is that value chains are of course, global. Firms not only strategically exploit national differences, whether regulatory or in terms of fitting marketing communications to different national contexts, but crucially, the science can be originated in one country, translated into an applied technology in another, travel across continents in the manufacturing process, be imported into another, and sold into markets thus reaching the hands of consumers in

another. In regulatory terms, this suggests that in the absence of an international regulatory body, N&N would have to be regulated through 'border-control' either at the level of the nation-state or up-scaled to a regional block such as the European Union, in such a way which is much more aware of the significance of global supply chains than currently appears to be the case.

We can conclude from the above that:

- National Regulatory differences matter and play a role in shaping the economic geography and value chains for nano-enabled consumer products.
- Producers assume that national consumer market differences matter. They strategically use these differences in the marketing of their nano-enabled products, including but not specifically about how the nano-dimension is represented to consumers.
- Large transnational corporations are complex organisations, spanning national borders and with specialist staff spanning many functions. Our preliminary findings suggest that the 'scientists' and the 'marketers' are not always in agreement about how nano-enabled products should be marketed.

Finally, the short theoretical reprise demonstrates a number of key points. Primary among these is whether distributed innovation processes need to be matched by distributed governance mechanisms, and therefore a notion of *distributed responsibility* as necessarily a 'good thing'. Or whether paradoxically distributed innovation systems, precisely because they are characterised by global interdependencies of expert labour, whether scientists or marketers, are more appropriately – better? – governed by top-down regulation. Second and lastly is the issue of *temporal distribution*.

As noted elsewhere, real-time regulation [7] attempts to resolve the too-little/too-late regulatory dilemma. The basic premise is that there exists an inherent temporal tension. Real-time regulation is based on the idea that if regulators intervene 'too late' then the nano-horse may already have bolted, and in a worst case scenario, an industrial-scale 'accident' may have already occurred, or indeed such an accident has a higher probability of occurring in a less, rather than a more, regulated context. But regulate 'too soon' and one risks the flip-side of stopping or stalling a process which has the potential to provide a significant scientific breakthrough in key areas of health, hunger, environment protection, or resource-use efficiency.

The response to this from Europe's regulators has been the promotion of the notion of 'continual vigilance' on the part of all actors in the system. This is not envisaged as *replacing* obligations under more top-down instruments of law, but rather as an adjunct to it, creating a regulatory mix which incorporates notions of vigilance and responsibility as temporary measures whilst directives are negotiated and codified, or more likely existing as a more or less permanent and arguably democratic set of institutions sitting alongside codified law, as a part of a mix of hard and soft regulatory 'tools'. The negotiation, contestation and crystallisation of such a regulatory mix defines the process that we are currently witnessing. Evaluation of its effectiveness as an innovative meta-regulatory method in the governance story of N&N will be the topic of policy and academic debate for many years to come.

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