

# Marketing of nanoproducts: in search of solutions

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## **Abstract**

This article describes the phenomenon of the new market of nanoproducts and attempts to assess the capacity and structure, positioning nanoproducts, consumer behavior, current and future demand – the data required to marketing of nanoproducts. Factual numbers in the article are based on data and analytical consulting company, global nanotechnology industry and field marketing research of nanotechnology in Russia performed by the author in the framework of the draft Federal target program "Development of nanotechnology infrastructure in the Russian Federation in 2008-2011".

**Keywords:** *nanotechnology; nanoproduct; marketing; marketing research; market capacity; time of entry into the market; nanoproduct positioning; testing demand; target group of consumers*

A little rock, thrown onto a still water surface, creates beautiful concentric ripples. This effect could be used as an analogy for describing the way nanoproducts market develops, wherein nanomaterials (core of the market) act as a basis and gradually find their use in the key sectors of the market: manufacturing, medicine, energy industry and IT. In the long run, nanomaterials get to the consumer market.

Nanoproducts market development does not confine itself to the rippling effect, it's a much more complicated and country-specific process, as well as coinciding with the economic destabilization in Russia and worldwide. The ongoing crisis, apart from the obvious nanotechnology commercialization difficulties, provides a unique chance for the industry, since, as the business history tells – the biggest funds were formed during or at the end of a crisis. Right now, those who produce and sell nanoproducts have the aforementioned opportunity.

It is important to bear in mind that the key demand-driving factor is offering radically new value to a consumer. In this sense, nanotechnology and nanoproducts not only develop the existing markets, but also create new, high-capacity ones. A TV that could be folded like a napkin and carried in a pocket, a new type of low electricity consuming lighting, bone tissue growing – all of this is being introduced to the market, thanks to nanotechnology. The list goes on, since, apart from traditional items and gadgets we are used to, there are brand-new products currently emerging - a new type of paint, which protects the surface from scratches, high-definition holograms able to imitate any kind of moving object, renewable energy sources etc.

Creating new consumer value doesn't mean it will be automatically acknowledged in the market. In this case it is very surprising to hear the following statement: if a given nanoproduct is better than its counterparts – it needs to be produced in greater quantities. The questions about who's going to buy it, how to use it without proper equipment, whether there is enough money at the producer and consumer disposal - are secondary. This kind of "marketing naïveté" has been demonstrated by some outstanding physicists. Unfortunately, things are much more complicated. Marketing has proved a long time ago - the market itself, the existing and prospective needs are starting points needed for the new product to be easily "absorbed" into the market, so that there is no need to waste effort "pushing it in" (which is what actually happens with a product nowadays). In practice, using the market as a starting point means operating marketing evaluations. Some of these evaluations are introduced in this article.

## **Market capacity**

According to our own ratings and the Russian government-approved criteria for attributing certain products to the nanoproducts group, the overall capacity of the global nanoproduct market amounts to \$400 billion. The industrial sectors of the global market are dominated by sales in manufacturing, medical and energy industries. The leading spots among nanoproducts are taken by nanocatalysts, hydrocarbon-processing nanoproducts, pharmaceutical preparations and medical equipment. New nanoproducts are being introduced to the market by the hundred.

The annual global market growth rate is averaging 17%. The growth in question is not gradual. There are tens of promising product niches boasting accelerated growth, for example: solar energy conversion (300% annual growth rate), optical electronics - 53%, medical research, clinical diagnostics, medical equipment using nanotechnology - 32%, fuel nanocells - 23%, nanocomposites - 20% etc. In 2015 global market capacity is expected to reach a \$500 billion mark and surpass \$1 trillion if the full cost of consumer nanoproducts is taken into account [1].

Despite the fact that Russian share of the global nanoproduct market is still low - around 0,25% (USA companies make up 50%), almost 70% of the attractive niches have been developed in part by Russians. Furthermore, Russians create about 10% of brand-new niches,

which are absent or in development in the rest of the world. Russian nanoproduct sales are expected to multiply over the next 2-3 years, as most of the recent projects reach the production stage. By 2015 the overall Russian nanoproduct sales are to reach 900 billion rubles.

## **Market entry timing**

This term is actually a marketing category. Also it's important to understand that no one is waiting for no one in this market. Striking your own "gold mine" is a matter of professionalism and perseverance. Another reason for Russian companies to join the "nano race" on time is the fact that the market is undergoing some changes, since the corporate investment in nanotechnology has exceeded that of the government. Foreign high-tech businesses have sensed the opportunity and every year invest more than \$10 billion in nanotechnology innovations that potentially create long-term competitive advantages. Of course, the pioneers earned some bumps and bruises on the way, the are, however, the ones to reap the rewards first, dictate new rules of business and capture the most prospective market segments.

## **Consumer's attitude towards nanoproducts**

To understand the conditions for market entry it's necessary to know the general attitude of potential consumers towards nanoproducts. To find this out, a nationwide field study took place in 7 major cities in Russia (with 3500 people taking part). The study included current nanotechnology development evaluations, forecasts for the near future and the attitude towards the government nanotechnology policy.

The survey results show the positive outcome of an ongoing campaign to raise nanotechnology awareness among the public: more than half of the city population of Russia (52%) is aware of nanotechnology and more than a quarter (26%) understands the gist of innovations in question. It did not come as a surprise that the highest awareness figures have come from Moscow and Novosibirsk.

Potential customers have rated the regions with the highest need for nanoproducts currently and in five years time. First three positions are taken by electronics, medicine and aerospace industry.

People expect that even though we will witness brand-new nanoproducts with brand-new features emerging on the market, they will only start to be actively used in our everyday lives in at least 5 years.

More than half of Russians (55%), who are aware of nanotechnology, have a positive attitude towards it and associate it with innovation and high quality. Only 3% have a negative opinion. These 3% fear that nanotechnology is harmful for one's health and may lead to unexpected consequences for the society. As the income declines and the age increases, there

are more people with negative attitude towards nanotechnology.

## Demand testing

The recent national nanoproduct demand testing yielded quite positive results. 30-50% citizens have shown their willingness to buy nanoproducts. Overall market capacity for products included in the research (diode house lamps, nanoparticle-containing knitwear and medical nanoplasters) amounts to 171 billion rubles (figure 1).

	DIODE HOUSE LAMPS	SOCKS CONTAINING SILVER NANOPARTICLES	MEDICAL NANOPLASTER
MAJOR RUSSIAN CITIES POPULATION, PEOPLE	103 690 400	103 690 400	103 690 400
X			
SHARE OF PEOPLE READY TO BUY THE PRODUCT AT AN OPTIMAL PRICE	51%	35%	29%
X			
OPTIMAL PRICE	170 RUB.	265 RUB.	190 RUB.
X			
AVERAGE NUMBER OF PRODUCT UNITS PURCHASED PER YEAR	10 UNITS	2 PAIRS	25 UNITS
X			
REPLACEMENT RATE	0,1 TIMES PER YEAR	1 TIMES PER YEAR	1 TIMES PER YEAR
=			
MAXIMUM ANNUAL SALES	9,0 BILLION RUB.	19,2 BILLION RUB.	142,8 BILLION RUB.
<b>OVERALL CAPACITY FOR GIVEN PRODUCTS — 171 BILLION RUB.</b>			

Figure 1. Potential demand for consumer nanoproducts (b2c market)

During the demand testing, target groups were defined - including people willing and not willing to purchase nanoproducts (ready to support/protest nanotechnology innovations). Those "for" are mainly men aged 15-34, students or entrepreneurs, with a humanitarian sciences (or biology and medicine) degree, working in media, energy, state and municipal organizations, social services, agriculture, and have a high annual income. Those "against" are mainly over 50, working (having worked) in arts and culture, having an academic degree and low annual income. The "for" group is the main target group for designing and implementing nanoproduct selling programs. Nanoproducts should be aimed at use by this target group.

## "Marketing funnel"

In addition to the previously described demand testing, a specific testing was carried out in order to determine the extent to which the nanoproducts are introduced to the market. The target audience is the userbase of a specialized internet information portal - "Nanotechnologies and nanomaterials" - [www.portalnano.ru](http://www.portalnano.ru)

Unlike Russian citizens in general, the audience of the aforementioned internet portal is aware of nanotechnology to a much greater extent. Apart from people involved in the b2c market, the userbase of the website included nanotechnology specialists dealing in b2b markets, hence, some of the tested products were described not from the field-of-use point of view, but, rather, the technology - nanocomposites, nanocatalysts etc.

The attitude towards nanoproducts was determined through using a specific demand forming model - the "marketing funnel". Respondents assessed each product on the following scale: "not aware - aware - familiar - bought - used - recommend". The respondent (either a real or potential customer) may choose one category, and all the previously named ones are added automatically.

The model's clearness is reached through visual comparison of the funnel's narrowing on each level of customer's attitude towards the product. The expansion of the funnel (bottom to top) is the effect of stable market expansion. Thus, the actions aimed at closing the gap between the levels stimulate product's market presence. Taking the biggest gaps between the levels if the funnel into account, the effort, needed to expand the funnel on its key levels, can be made using specialized means of marketing communication. This approach can effectively influence one's attitude towards the product and increase the number of users.

Figure 2 shows the overall attitude towards nanoproducts among the whole userbase that took part in the research. The shares illustrated in the funnel show the average level of, respectively, awareness, purchase experience, and usage of the 25 products, designated for testing. According to the figure, a significant narrowing of the funnel for the "involved" respondents takes place during the "familiar-bought" stage. Currently, less than 10% of participants have practical experience of purchasing and using nanoproducts.

A significant narrowing of the funnel (I.e., a decline in the number of potential customers) occurs on the first three stages:

1) "aware" - only about a half of respondents have heard anything about the nanoproduct and are aware of its existence.

2) "aware-familiar" - the funnel halves itself

3) "familiar-bought" - the funnel collapses by four times

The quantity features of the funnel for each of the tested nanoproducts are given in table 1.



Figure 2. "Marketing funnel" for the tested nanoproducts

Market introduction characteristics for nanoproducts  
(nanoproducts "marketing funnel" specification)

Groups of nanoproducts	Aware	Familiar	Purchased	Used	Would recommend
Electronic and electric goods	85%	49%	22%	18%	7%
Solar batteries and cells	73%	39%	6%	5%	3%
Car parts and paints	71%	35%	7%	6%	4%
High brightness LEDs	70%	42%	12%	10%	6%
Fabrics and clothes	69%	37%	9%	8%	5%
Nanosensors	65%	30%	4%	4%	3%
Nanocomposites	63%	36%	8%	8%	6%
Medical equipment	61%	28%	3%	2%	2%
Water filters	61%	28%	9%	8%	5%
Photography and optics	61%	27%	5%	5%	1%
High dissolution medicine	60%	24%	4%	3%	1%
Cleaning products	57%	27%	11%	8%	4%
Space-saving fuel cells	54%	24%	4%	3%	1%
Nanocatalysts	53%	23%	5%	5%	5%
Sunblock products	51%	24%	7%	6%	1%
Personal hygiene products	49%	25%	13%	10%	4%
Orthopaedic and stomatologic products	49%	19%	0%	0%	0%
Antibacterial compounds	47%	25%	11%	9%	5%
Sports equipment	44%	21%	6%	5%	1%
Beauty care products	43%	16%	3%	1%	1%
Cancer treatment	41%	17%	1%	1%	0%
Foods and beverages	41%	15%	3%	1%	0%



Antioxidants	31%	11%	3%	3%	2%
Aerogel building isolation	28%	14%	1%	1%	0%
Hormone therapy	25%	8%	0%	0%	0%

The purchasing and using experience was recorded by an insignificant amount of respondents (0 to 13 percent depending on the product). The only exception is electric and electronic goods made with nanotechnology: 22% have purchasing experience and 18% - usage experience. The marketing funnel of these products is the broadest among the whole list. The next items on the list in terms of "consumer readiness" are LEDs, personal hygiene products, antibacterial compounds and cleaning products.

The outsiders on this list are hormone therapy products, aerogel isolation for buildings, antioxidants, beverages and foods, cancer drugs and beauty care products.

The yielded results are not surprising for innovative products. As the market develops, the situation is to improve. The product platform scale and its constant growth are the best proof of that [2].

## **Nanoproduct positioning**

The formation of attractive nanoproduct purchase conditions calls for a calibration of traditional marketing procedures, with the nanoproducts novelty taken into account.

The driving idea for positioning should be the attractiveness of positive effects of nanoproducts usage with a demonstration of improved features as well as social, ecological, resource, informational and economic effects for the consumer. During the research, the said effects were distinguished and assessed (table 2,3).

It's important to note that some negative effects were found out: negative health influence, ecological, socio-ethical and economic effects. The first two effects are the most important, since they can prevent potentially harmful nanoproducts from being released.

It's necessary to point out that potential negative economic consequences are the least discussed right now. With the continued growth of nanoproducts market, some existing markets, like TVs and screens, can be damaged, which draws severe repercussions for certain industries and a country's economy as a whole. The negative outcome of issuing patents for nanomaterials can be seen as "privatisation" of nature's very building blocks.

Table 2

Basic positive effects of nanoproducts usage in refinement industry, medicine and biotechnology

Market sectors	Types of effects				
	Enhancing product properties	Resource effects	Social effects	Ecological effects	Informational effects
Refinement industry	<ul style="list-style-type: none"> <li>- improving usage properties of existing machines, materials and equipment</li> <li>- creation of more durable, lighter and cheaper materials</li> <li>- creation of machines and equipment with new and unique usage properties and features</li> </ul>	<ul style="list-style-type: none"> <li>- final product cost reduction</li> <li>- decrease in energy and resources consumption</li> <li>- human resources saving</li> <li>- increase in parts and machines useful lifetime</li> </ul>	<ul style="list-style-type: none"> <li>- increase in employee security</li> <li>- increase in jobs</li> <li>- increase in employee qualification</li> <li>- increase in high-tech products accessibility</li> <li>- decrease in initial citizen differentiation</li> </ul>	<ul style="list-style-type: none"> <li>- decrease in harmful emissions</li> <li>- improvement of a region's ecological security</li> <li>- decrease in production waste</li> <li>- increase in Eco-friendly production</li> <li>- increase in ergonomic goods production</li> </ul>	<ul style="list-style-type: none"> <li>- new knowledge, skills, and scientific/intellectual technologies accumulation</li> <li>- transition to radically new nanotechnologies</li> </ul>
Medicine and biotechnologies	<ul style="list-style-type: none"> <li>- decrease in preparation dosage</li> <li>- more focused medicine effect</li> <li>- a decrease in side effects</li> <li>- an increase in medicine usage efficiency</li> <li>- creation of medicine</li> </ul>	<ul style="list-style-type: none"> <li>- decrease in treatment and surgery time</li> <li>- increase in one's active/working life</li> <li>- increased birth rate</li> <li>- decrease in death rate</li> </ul>	<ul style="list-style-type: none"> <li>- medical service market development</li> <li>- increase in life expectancy</li> <li>- creation of long-term health control systems</li> <li>- revolutionary healthcare changes (creation of low-intervention and no-</li> </ul>	<ul style="list-style-type: none"> <li>- decrease in "biological pollution" of the environment</li> <li>- biological balance maintenance</li> </ul>	<ul style="list-style-type: none"> <li>- accumulating knowledge on human anatomy and nature</li> <li>- increase in medical diagnostics informativity</li> <li>- opportunity to obtain more accurate knowledge about organisms and</li> </ul>

Market sectors	Types of effects				
	Enhancing product properties	Resource effects	Social effects	Ecological effects	Informational effects
	with new effect mechanics (e.g. pills that activate as one's body temperature rises) - creation of artificial tissue and organs, which don't induce body rejection		intervention healthcare)		pathological processes development

Basic positive effects of nanoproducts usage in electronics and IT, energy industry

Table 3

Market sectors	Types of effects				
	Enhancing product properties	Resource effects	Social effects	Ecological effects	Informational effects
Electronics and IT	- a radical increase in devices memory capacity - a decrease in the size of processors for supercomputers - a broader operational	- a significant decrease in power consumption - decreased production cost due to lower power consumption, size and weight	- higher presence in relative industries like medicine, fossil fuels exploration, military industry. - medical service	- opportunity to use natural resources more efficiently and with reduced damage to the environment	- higher usability of informational resources and technologies - improved education system and intercultural communications

Market sectors	Types of effects				
	Enhancing product properties	Resource effects	Social effects	Ecological effects	Informational effects
	<p>frequency range</p> <ul style="list-style-type: none"> <li>- increase in speed and volume of transmitted information for communications and radio transmissions</li> </ul>	<ul style="list-style-type: none"> <li>- increased useful lifetime of electric machines</li> </ul>	<p>development, improvement of preventive diagnostics systems</p> <ul style="list-style-type: none"> <li>- reduced cost of medical examination</li> <li>- revolutionary changes in healthcare and environment protection organizations</li> <li>- development of "home healthcare" systems</li> <li>- development of care systems for disabled people</li> </ul>		<ul style="list-style-type: none"> <li>- information globalization</li> </ul>
Energy industry	<ul style="list-style-type: none"> <li>- more efficient energy production</li> <li>- increase in electricity usage efficiency</li> <li>- decrease in resources consumption</li> </ul>	<ul style="list-style-type: none"> <li>- renewable energy sources usage</li> <li>- reduced energy consumption</li> <li>- financial resources saving</li> <li>- reduced semiconductor materials usage</li> <li>- reduced sun energy cost</li> <li>- reduced consumer goods production cost</li> </ul>	<ul style="list-style-type: none"> <li>- increased energy production security</li> <li>- discovery of new energy sources</li> </ul>	<ul style="list-style-type: none"> <li>- development of environmentally friendly transportation</li> <li>- development and creation of new energy sources</li> <li>- prevention of further ozone depletion</li> <li>- decrease in likelihood of cancer and heart diseases</li> <li>- more efficient waste</li> </ul>	<ul style="list-style-type: none"> <li>- accumulation of new knowledge, work skills, technological, scientific and intellectual potential of the society</li> </ul>

Market sectors	Types of effects				
	Enhancing product properties	Resource effects	Social effects	Ecological effects	Informational effects
		- energy efficiency		recycling - cease of ecologically dangerous materials - prevention of dioxins use - reduction and cease of sulfur and nitrogen oxides	

## **Communication codes**

As the recent advertising tests show, getting the message about the positive effects of nanotechnology across is most effective using the communication codes of humanity (mission), mythology (origins), broadcast (authority), stating (advantages), segmentation (purpose). A significant motivational element is the "by definition, by origin, by reputation, by order, as a feature" qualities of the nanoproduct.

The "new quality" idea is especially important for promoting a nanoproducts producer on the b2b market with an emphasis on functional practicality of nanoproducts, including reliability, innovation, accordance to certain requirements, aesthetics, ease of repair. For end customers (b2c) associative, perceptual, analogue communication techniques are usable, as well as placing nanotechnology information in popular culture context, organizing important and interesting events, non-competitive positioning, using additional and secondary product attributes.

PR support is necessary in this case, including internet support: banners, rich-media, screen glide technology, video banners, peel down, online videos, all of which helps with educating, developing new attitude and myth dispelling.

The nanoproduct marketing recommendations described here are not all-encompassing. The author perceives them as a basis for starting professional work in this field. Specialized marketing research and adaptation mechanism design are needed to define features of certain market sectors and segments. Nanoproduct global promotion actions must be supported by export stimulation and new companies and products branding. Obviously, the said work isn't active enough. The emergence of the first Russian nanotechnology companies and external actions against national resource doctrine ought to give this work the needed momentum.

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