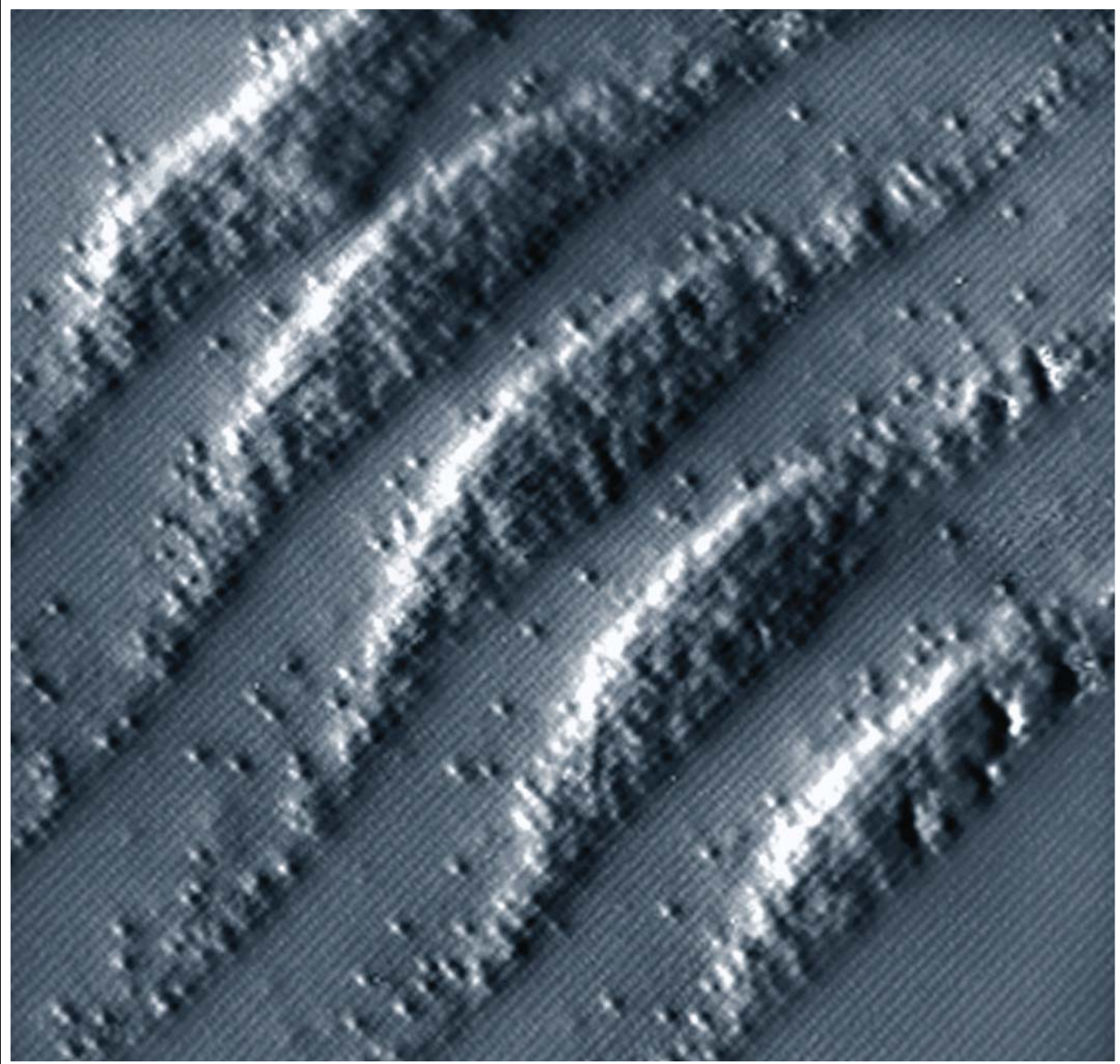


*A Market & Technology Assessment Report
March 2008*

Nanotechnology in Wireless Handsets



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CHAPTER ONE

Abridged Executive Summary

SALES INFORMATION:

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click here.**

Cover Photo Description: Atomic resolution Scanning Tunneling Microscope (STM) image showing stacks of self-assembled quantum dots. Quantum dots are being actively researched as one of the key nanomaterial components for wireless handsets.

Source: Image by D. Bruls and P. M. Koenraad—Eindhoven University of Technology, Netherlands; The EPSRC nanotechnology image library; <http://www.nanofolio.org/images/gallery04.php>; This work is licensed under a Creative Commons Attribution-No Derivative Works 3.0 License; <http://creativecommons.org/licenses/by-nd/3.0/>.

Pioneer Consulting believes that nanotechnology is poised to play a major role in the wireless handset components market.

Pioneer Consulting forecasts that the market for nanotechnology-enabled wireless handset components will grow close to 14 times from 2008 through 2012 at a CAGR of 69.2%. Regional rankings for the break-up of the revenues will be as follows:

- APAC
- Europe
- MEA
- NA
- CA-LA

The rankings for growth rate will be as follows:

- MEA
- APAC
- CA-LA
- NA
- Europe

Nanotechnology establishes a ready resonance with wireless handset requirements due to the formidable engineering and business challenges that govern the selection of individual handset component materials. Exhibit 1.1 presents the wireless handset components identified by Pioneer Consulting and their contribution to the wireless handset BoM.

■ Exhibit 1.1: Individual Component Contribution Ranges for the Wireless Handset BoM

COMPONENTS	RANGE
<i>Antennas</i>	2% to 5%
<i>RF components</i>	15% to 25%
<i>Memory</i>	12% to 20%
<i>Processors</i>	20% to 30%
<i>Displays</i>	15% to 30%
<i>Batteries</i>	5% to 15%

Source: Pioneer Consulting © 2008

Pioneer Consulting has identified the following acute challenges that govern their material selection dynamics of wireless handset components:

- Antennas: Size economy, superior directivity, low inter-signal interference, low costs, tunability to a wider frequency range
- RF Components: Power economy, size economy, low inter-signal interference, low costs, tunability to a wider frequency range
- Memory: Higher capacity, power economy, lower boot time, size economy, low costs, non-volatility, quick response,
- Processors: Higher computing power, power economy, lower boot time, size economy, low costs, ability to support wide-ranging interfaces
- Displays: Granularity, sharpness, power economy, size economy of supporting components, low costs
- Batteries: Longer active and idle times, size economy, longer life

Nanotechnology-enabled materials and processes are being actively applied and extensively investigated to address the challenge of advancing towards the next generation of wireless handset technology paradigms in a seamless and efficient manner. The following major technologies and materials are being investigated:

- CNT/buckyballs
- Spintronics
- Quantum dots

MEMS acts as a bridge between present day processes and future nano-enabled processes enabling stakeholders to advance technologically without adverse business impact. Exhibit 1.2 summarizes the areas of applications of Nanotechnology in wireless handset components.

■ Exhibit 1.2: Summary of Applications of Nanotechnology and MEMS in Wireless Handset Components (Sample)

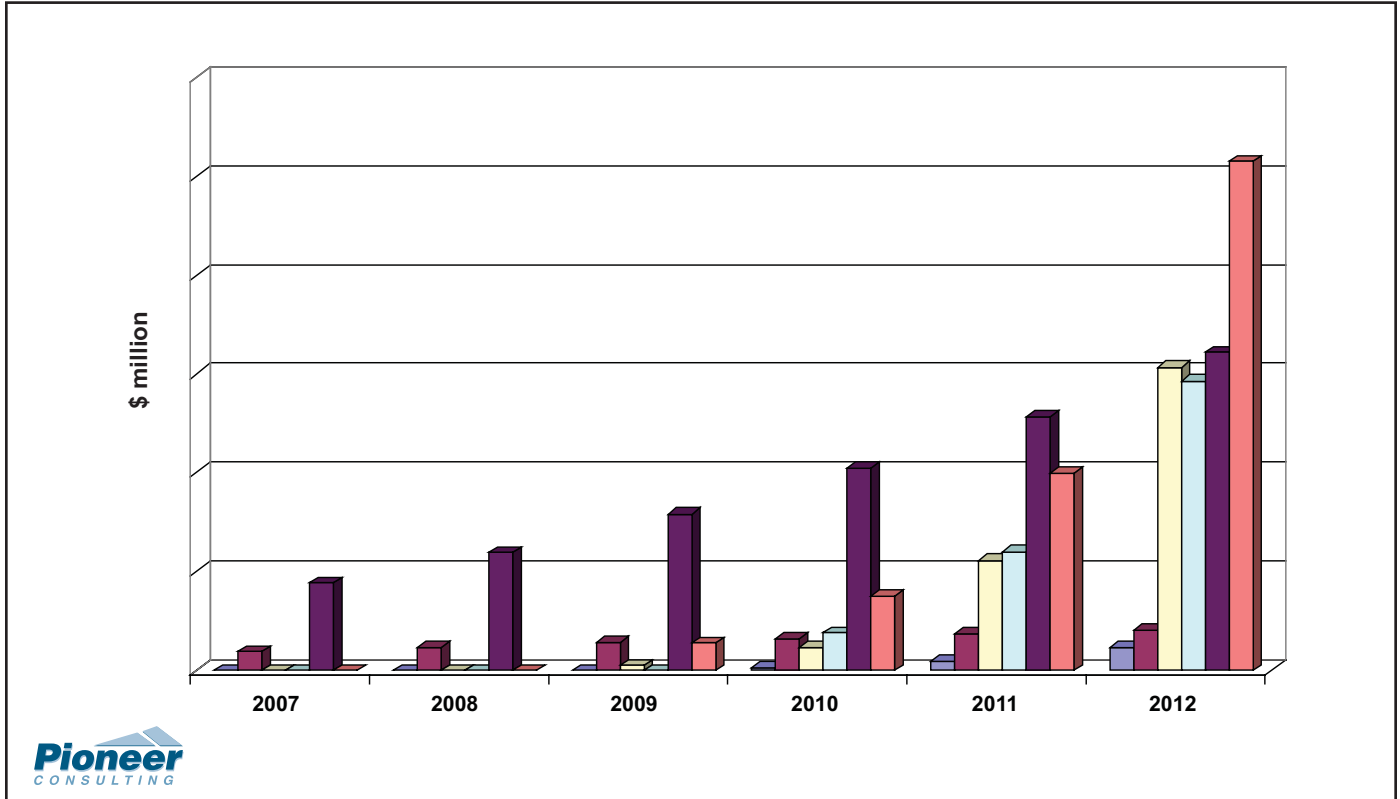
	ANTENNA	RF COMPONENTS	MEMORY	PROCESSOR	DISPLAY	BATTERIES
<i>CNTs/ (Fullerenes/ Buckyballs)</i>						
<i>Spintronics/Quantum Dots</i>						
<i>MEMS</i>						
<i>Other Nanomaterials</i>						

Source: Pioneer Consulting © 2008

The above nanotechnology materials and process have led to the development of concrete options in wireless handset components. Pioneer Consulting forecasts that all the above nanotechnology-enabled wireless handset components will be available commercially by 2010.

The timeline summary and market size for nanotechnology enabled wireless handset component market is presented in Exhibit 1.3.

Exhibit 1.3: Market Breakdown of Different Nanotechnology Enabled Handset Components (Sample)



	2007	2008	2009	2010	2011	2012	CAGR (%)
<i>Market for nanotechnology enabled wireless handset antennas (million)</i>							
<i>Market for nanotechnology enabled wireless handset RF components (million)</i>							
<i>Market for nanotechnology enabled wireless handset memory (million)</i>							
<i>Market for nanotechnology enabled wireless handset processors (million)</i>							
<i>Market for nanotechnology enabled wireless handset displays (million)</i>							
<i>Market for nanotechnology enabled wireless handset batteries (million)</i>							
TOTAL							

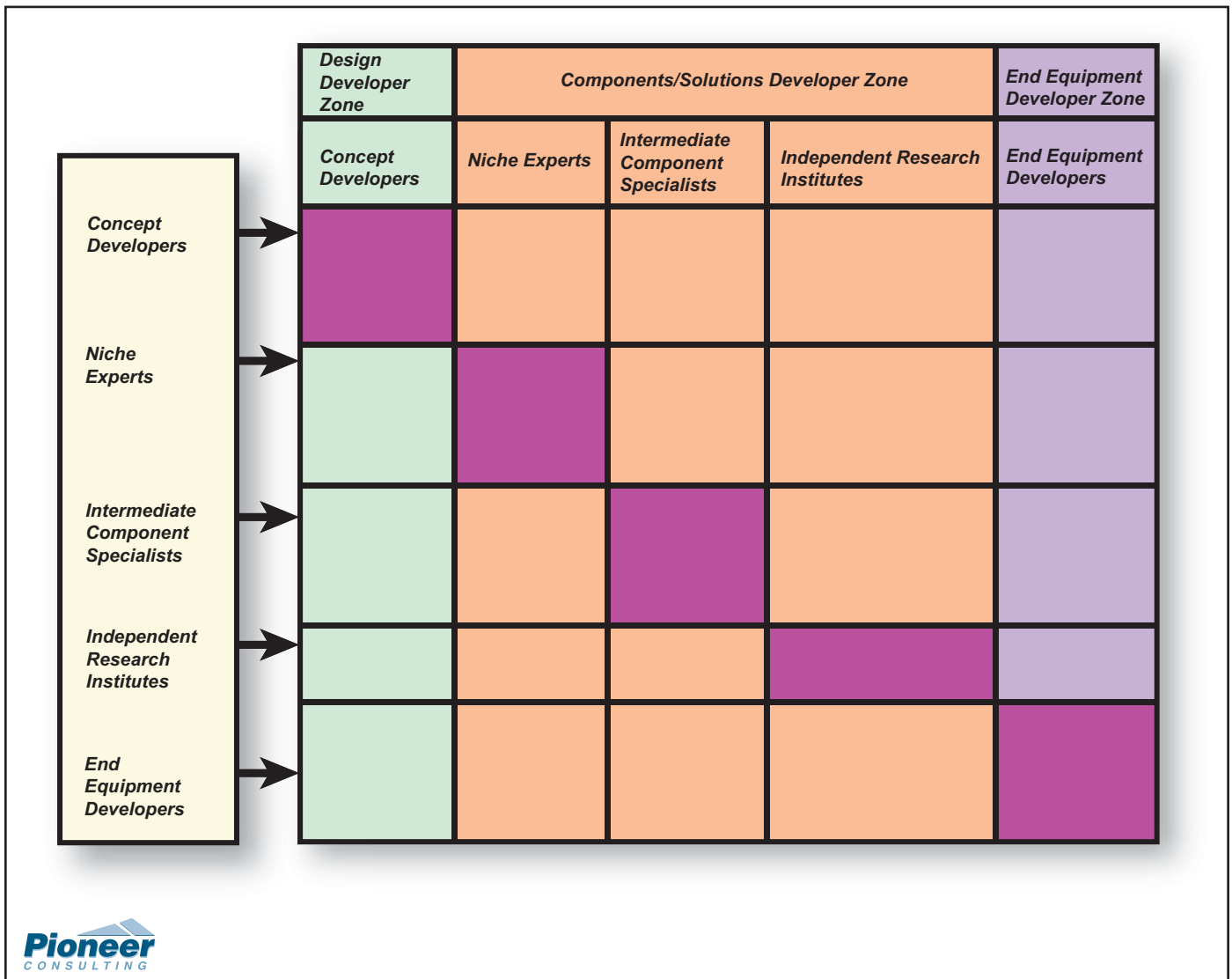
Source: Pioneer Consulting © 2008

The development of nanotechnology enabled wireless components will be spearheaded by the following stakeholder groups:

- Niche experts
- End equipment developers
- Intermediate component specialists
- Independent research institutes
- Concept developers

The value-chain organized by these stakeholders is summarized in Exhibit 1.4 below.

Exhibit 1.4: Nanotechnology Enabled Wireless Handset Component Stakeholder Value Chain (Sample)



While nanotechnology will bring substantial value-additions to the table, its introduction in wireless handset components is beset with formidable challenges. A summary of these benefits and challenges is presented in Exhibit 1.5.

■ Exhibit 1.5: Benefit-Challenge Analysis for Nanotechnology Enabled Wireless Handset Components (Sample)

	BENEFITS	CHALLENGES
<i>CNT Antennas</i>		
<i>FBAR Duplexers</i>		
<i>NRAM</i>		
<i>MRAM</i>		
<i>Molecular Memory</i>		
<i>Ovonic Memory</i>		
<i>CNT Processors</i>		
<i>TFT OLED</i>		
<i>DMFCs and Hydrocarbon Based Membranes</i>		

Source: Pioneer Consulting © 2008

Exhibit 1.6 (on the following page) presents the stakeholders analyzed in this report along with their classification and activity summary.

■ Exhibit 1.6: Stakeholder Classification and Activity Summary (Sample)

Stakeholder/ Vendor	Niche Expert	End Equipment Developer	Intermediate Component Specialist	Research Institute	Concept Developer	Specialty
	Y					Display
	Y					Batteries
	Y					Memory
	Y					Antenna
	Y					Batteries
	Y					RF components
	Y					Multi-purpose
	Y					Memory
		Y				Multi-purpose
		Y				Multi-purpose
		Y	Y			Multi-purpose
			Y			RF components
			Y			Memory
			Y			Multi-purpose
			Y			Multi-purpose
			Y			Batteries
				Y		Multi-purpose
					Y	Multi-purpose

Source: Pioneer Consulting © 2008