

MISRC Research Seminar  
University of Minnesota, Minneapolis, MN  
05/06/11

## MOBILE TECHNOLOGY: ADOPTION, DESIGN AND SUSTAINABILITY LESSONS

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Based on published articles and working papers by A. Chircu and V. Mahajan.  
Partially supported by a fellowship from the Valente Center at Bentley University (A. Chircu, 2010-11) and a grant from the University of Texas at Austin (A. Chircu and V. Mahajan)

## Agenda

- Mobile technology adoption and usage patterns in developing and developed countries
- Implications and discussion

### *Break*

- Mobile phones design practices
- Mobile phone sustainability lessons
- Implications and discussion

# Mobile Devices Worldwide

## Mobile Subscriptions (ITU, 2010)

- 2010: 4.6 billion
  - 73% mobile subscriptions in developing world (from 53% in 2005)
- 2011: 5 billion

## Mobile Access (ITU, 2010)

- 90% of the world population
- 80% of the rural population

## Mobile Devices

- 2008: 886 million phone sales, \$172 billion market value (Euromonitor, 2008)
  - India and China: 28% of volume, 18% of value
  - US: 14% of volume, 15% of value
  - Western Europe: 18% of volume, 21% of value, 18% volume
  - China (123 million phones, \$24 billion value) ~  
US (122 million phones, \$25 billion value)
- Predictions, 2012: 1.9 billion units sales, \$202 billion market value (Datamonitor, 2008).
- New data, 2010: 1.6 billion mobile devices sales (Gartner, 2011)
- New predictions, 2015: 2.1 billion units sales (IDC, 2011)

## MOBILE TECHNOLOGY ADOPTION

Based on Chircu, A. M. and Mahajan, V. "PERSPECTIVE: Revisiting Digital Divide - An Analysis of Mobile Technology Depth and Service Breadth in the BRIC Countries," *Journal of Product Innovation Management*, 26, 4, pp. 455 – 466, 2009.

## Digital Divide

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- Gap in accessing and using ICTs (Dewan et al. 2005)
  - Between developed and developing countries
  - Between individuals, households, businesses, geographic areas
  - ICTs: land lines, PC's, mainframes, Internet connections, mobile phones,...
- Theoretical underpinnings
  - Technology diffusion
  - New product adoption and diffusion
- Open research question (Dewan and Riggins 2005)
  - Higher growth rates in developing countries (vs. developed ones)
  - New emerging technologies: mobile communication

## Mobile Communication Technology

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- One of the newest, fastest growing ICTs
  - Double-digit growth rates, 2005-2010
  - More mobile phones in developing countries than in developed countries
- Has not yet received as much attention from researchers as other, more established ICTs
- Promoted as solution for narrowing of the digital divide
- May be different than other ICTs
  - costs for adopters and technology providers
  - underlying infrastructure requirements

## Research Question

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- Can mobile communication technology bridge the digital divide between developed and developing countries?

## Digital Divide: Research Findings

Study	Technology	Context	Digital Divide Research Findings
Dekinpe et al. (1998).	Mobile	Across 184 developed and developing countries	Diffusion of technology is associated with high economic development, population homogeneity, and low death rates.
Dekinpe et al. (2000a)	Mobile	Across 184 developed and developing countries	Countries with homogenous and concentrated populations and high economic development adopt technology earlier. Countries are more likely to adopt as the number of similar countries that have adopted the technology increases ("demonstration effect").
Dewan et al. (2005).	Mainframes, PCs, Internet	Across 22 developed, and 18 developing countries	Digital divide exists due to the path-dependency of ICTs, which require a strong economy and sufficient levels of infrastructure, education and political development for widespread adoption.
Kauffman and Techatassanasoontom (2005)	Mobile	Across 43 developed and developing countries	Penetration is associated with telecom infrastructure, standards, and competition, as well as cross-country contagion due to geographical proximity to other adopting countries
Mariscal (2005)	Fixed line telephony Mobile	Developing country (Mexico)	Observed digital divide for fixed and mobile phone services in a developing country is higher than predicted by an economic market perspective (which encourages economic growth and regulatory policies). Narrowing the divide may require a social capital, or community-based approach to universal access.
Rouvinen (2006)	Mobile	Across 75 developed and 90 developing countries	Diffusion is encouraged by market competition and slowed by standards competition. A large potential user base, network effects, openness, technological level, and complementary innovations are more important for diffusion in developing countries. Late adopters experience faster diffusion.
Crenshaw and Robison (2006)	Internet	Across 58 developing countries	Structural characteristics such as infrastructure (fixed line telephones) and institutional environment (service sector employment, political openness, urban concentration) and globalization characteristics such as economic globalization (foreign direct investment, trade, and aid) and social globalization (tourist arrivals) impact Internet adoption in developing countries.
Boretos (2007)	Mobile	Across regions (Worldwide, Europe, China)	Mobile technology will reach 29.2% adoption level worldwide by 2008, with GSM likely to remain the leading mobile technology. Europe has already reached adoption peak. The number of mobile subscribers in China will be at least 500 million by 2008.

## New Product Adoption and Diffusion Problem

- S-curve
  - ▣ Adoption over time by groups of people (innovators, early adopters, early majority, late majority and laggards)
  - ▣ Total market potential
  - ▣ Information exchange / influences about innovation
    - external (mass media)
    - internal (interpersonal communication)
  - ▣ Covariates – structural perspective

## Path Dependency Perspective

- ICT adoption depends on structural factors
- Internal
  - ▣ Economic (income, prices)
  - ▣ Demographic (urban/rural, education, homogeneity, concentration/density, death rates)
  - ▣ Environment / infrastructure (land lines)
- External
  - ▣ Standards
  - ▣ Geography
  - ▣ Relationships – country-level
- Conclusion: Cannot achieve high adoption levels without achieving high levels on structural factors

## Broadening the Definition

- *Mobile technology depth* = level of adoption, or penetration (mobile phones, subscriber accounts)
  - ▣ Measure of choice in past studies

+

- *Mobile technology service breadth* = variety of mobile technology services available for adoption
  - ▣ Emerging perspectives on use variety, use-diffusion

## Methodology and Data

- Country-level case studies
  - ▣ Exemplary developing country cases: BRIC
    - Represent 42% of world population, 49% of developing world population
  - ▣ Matching developed country cases
    - Comparison group for BRIC - top 5 major industrialized economies in the world (USA, Japan, United Kingdom, Germany and France)
    - Others for geographical / adoption timing / income coverage
    - Represent 12% of the world population, 87% of developed world population
  - ▣ 2005 & 2006 data from ITU, World Bank
  - ▣ Nonparametric tests & qualitative analysis

Region	Country	Developed? <sup>a</sup>	GDP (current US\$, millions)	GDP growth (annual, %)	GNI per capita (current US\$)	Population (millions)	Nr. Fixed Line Subscribers (millions)	Nr. Mobile Subscribers (millions)	Mobile growth rate (2001-2006 CA GR, %) <sup>b</sup>
North America	United States	Yes	13,201,819	3%	44,970	301	172	233	13%
	Canada	Yes	1,251,463	3%	36,170	33	21	17	12%
Europe	United Kingdom	Yes	2,345,015	3%	40,180	60	34	70	9%
	Germany	Yes	2,906,681	3%	36,620	83	54	84	9%
	France	Yes	2,230,721	2%	36,550	61	34	52	7%
	Spain	Yes	1,223,988	4%	27,570	43	18	46	9%
Asia-Pacific	Japan	Yes	4,340,133	2%	38,410	128	55	102	6%
	Australia	Yes	768,178	2%	35,990	20	10	20	12%
	Hong Kong (China)	Yes	189,798	7%	28,460	7	4	9	10%
	Singapore	Yes	132,158	8%	29,320	4	2	5	10%
	Korea (Rep. of)	Yes	888,024	5%	17,690	48	27	40	7%
BRIC	Russia	No	986,940	7%	5,780	143	40	120	81%
	Brazil	No	1,067,962	4%	4,730	189	40	100	28%
	China	No	2,668,071	11%	2,010	1,324	368	461	26%
	India	No	906,268	9%	820	1,120	41	166	91%
Averages	<i>Developed countries</i>		<i>2,679,816</i>	<i>4%</i>	<i>33,812</i>	<i>72</i>	<i>39</i>	<i>62</i>	<i>9%</i>
	<i>BRIC countries</i>		<i>1,407,310</i>	<i>8%</i>	<i>3,335</i>	<i>694</i>	<i>122</i>	<i>212</i>	<i>57%</i>
	<i>Entire sample</i>		<i>2,340,481</i>	<i>5%</i>	<i>25,685</i>	<i>238</i>	<i>61</i>	<i>102</i>	<i>22%</i>
Totals	<i>Developed countries</i>					<i>788</i>	<i>431</i>	<i>678</i>	
	<i>BRIC countries</i>					<i>2,775</i>	<i>489</i>	<i>847</i>	
	<i>Entire sample</i>					<i>3,563</i>	<i>919</i>	<i>1,525</i>	
	<i>World</i>					<i>6,564</i>	<i>3,966</i>	<i>2,740</i>	

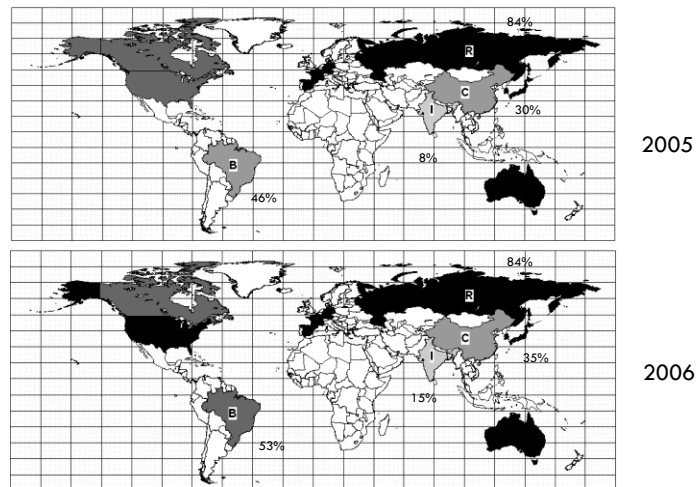
## Measures

- Mobile technology depth
  - ▣ number of mobile technology adopters / population (total, relevant)
- Mobile technology service breadth
  - ▣ %
  - ▣ 34 services available worldwide
  - ▣ five service categories (voice, data, media, information, and transaction services)

## Depth Findings

Lower levels in developing countries for both 2005 and 2006 ( $p=0.05$ )

0-24% 25-49% 50-74% 75-100%+ No Data

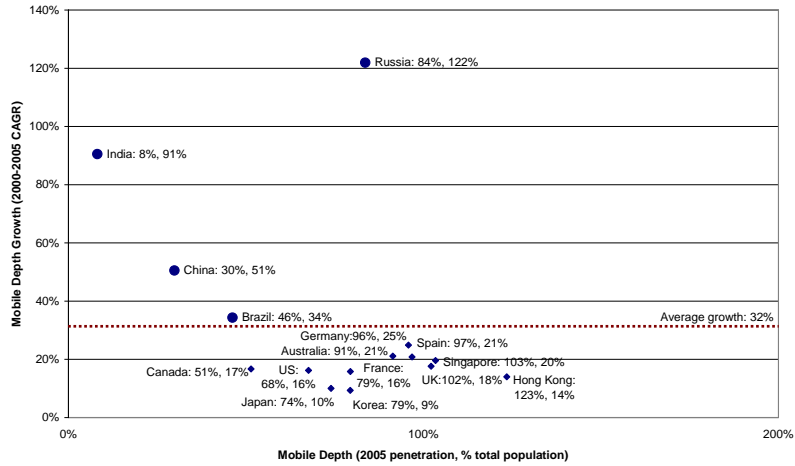


## However ...

- Growth rate
- Growth curve stage
- Relevant adopter population
- Mobile adoption - GDP growth cycle
- Individual vs. group adoption (sharing, joint household adoption decisions, social influences)
- Age distribution

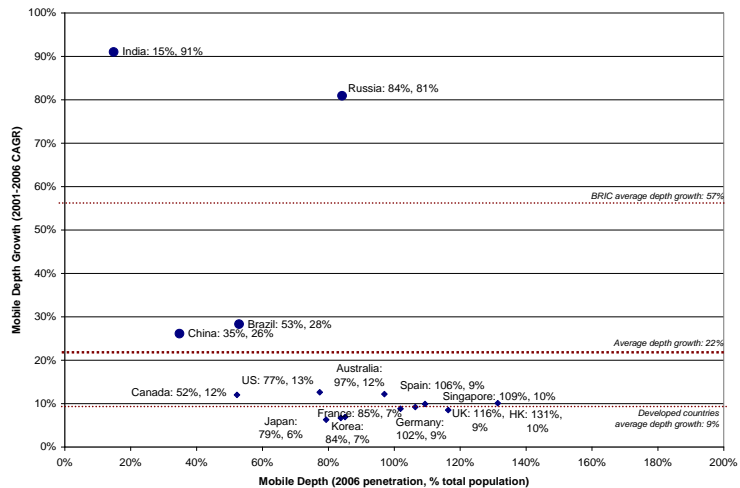
## Depth Growth Rate: Higher for BRICS: 2005

Significant differences  
( $p=0.01$ )

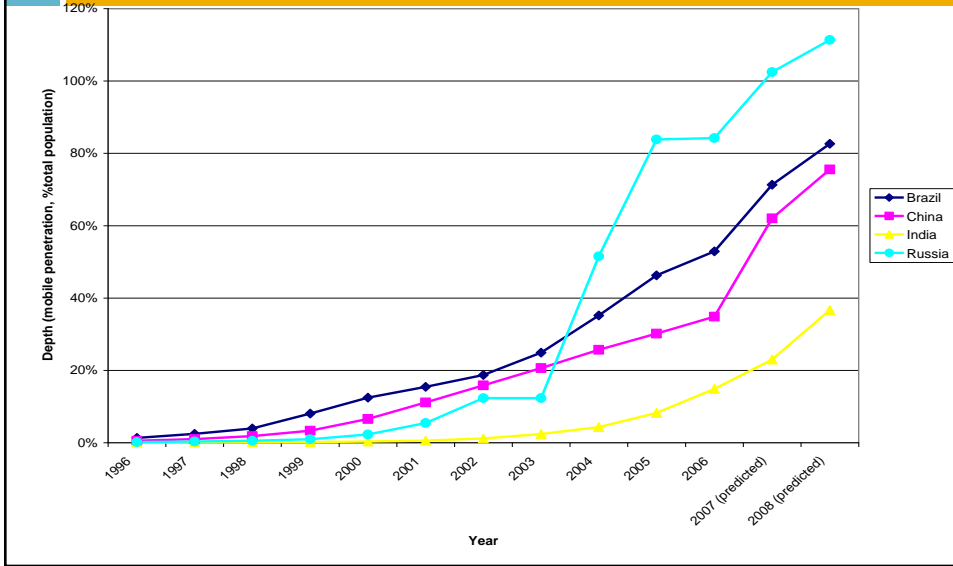


## Depth Growth Rate: Higher for BRICS: 2006

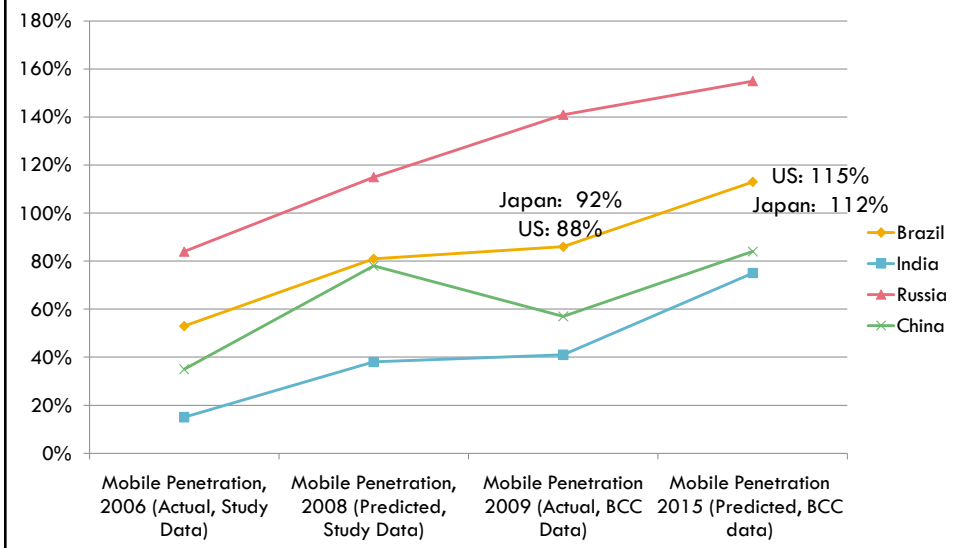
Significant differences  
( $p=0.01$ )



## BRICs: Depth Growth Curves



## BRICs: Depth Growth Curves 2010 Update



## Conclusion - Depth

- BRICs vs. developed countries digital divide (as measured by technology depth)
  - ▣ Exists
  - ▣ Is fast narrowing
  - ▣ Matches predictions of growth
  - ▣ May be over or under-measured → better measures
    - multiple SIMs – ex. Russia
    - household/group – ex. India

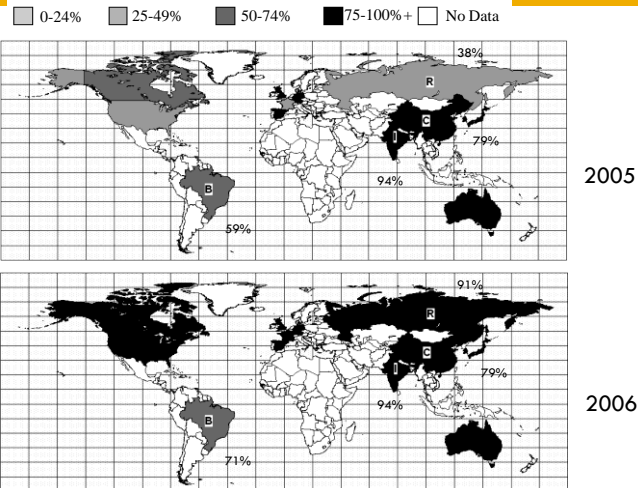
## Breadth: Service Categories

- Voice Services (caller id, waiting, forwarding, blocking, conference calling, roaming, ring tone personaliz, voicemail)
- Data Services (fax, messaging, email, general web access, and business access through a private network/VPN/Intranet)
- Media Services (games, entertainment - music and other audio entertainment, photos, video, and humor - jokes and animation)
- Information Services (entertainment information, directory, emergency, location and navigation, general news, advertising, financial information, personal organization information - appointments and calendars, travel information, sports news, lifestyle information, gambling information, weather information, traffic alerts)
- Transaction Services (banking, shopping transactions)

## Breadth Findings: Service Availability

**Original levels:** NS overall differences in 2005, significant ( $p=0.05$ ) in 2006; NS across 5 service categories in 2005; significant differences ( $p=0.05$ ) for media and information services in 2006; all @ very high levels (97% developed vs. 87% BRICS)

**Lo/med/hi levels:** NS differences overall; marginal difference in 2005 for voice services ( $p=0.1$ ) and in 2006 for media services ( $p=0.1$ ) and information services ( $p=0.1$ )



## Breadth Findings: Leapfrog

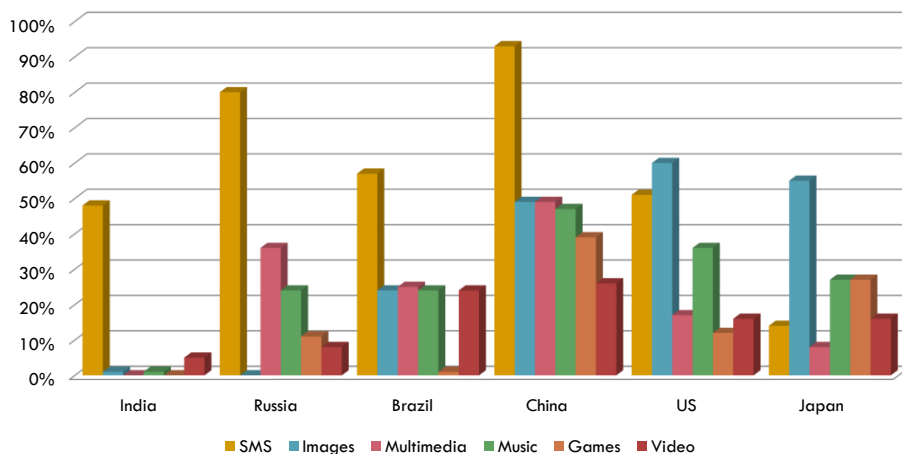
- Mobile technology service breadth as a way to leapfrog (offer same services w/o investing in more expensive ICTs)
  - ▣ Ex: India advertising “not a phone, but a PC”, usage by small businesses & farmers/fishermen/...
  - ▣ Ex: China – popular way for accessing the Internet vs. other controlled/censored info channels

## Breadth Findings: China

- 21-22% of mobile revenue (= \$108 bil Yuan) for China Mobile and China Unicom from services
- 50% of all 50 mil phones sold by Nokia in China were music phones (media)
- Competitive pricing encourages service adoption
- Ex:
  - ▣ Real-time stock quotes (info), trades (transaction)
  - ▣ Text messages (data) - 42 bil in 2005 (up to 1 bil/day in 2007)
  - ▣ News and sports to general population (info)
  - ▣ Specific information on farming best practices and crop prices to farmers (info)

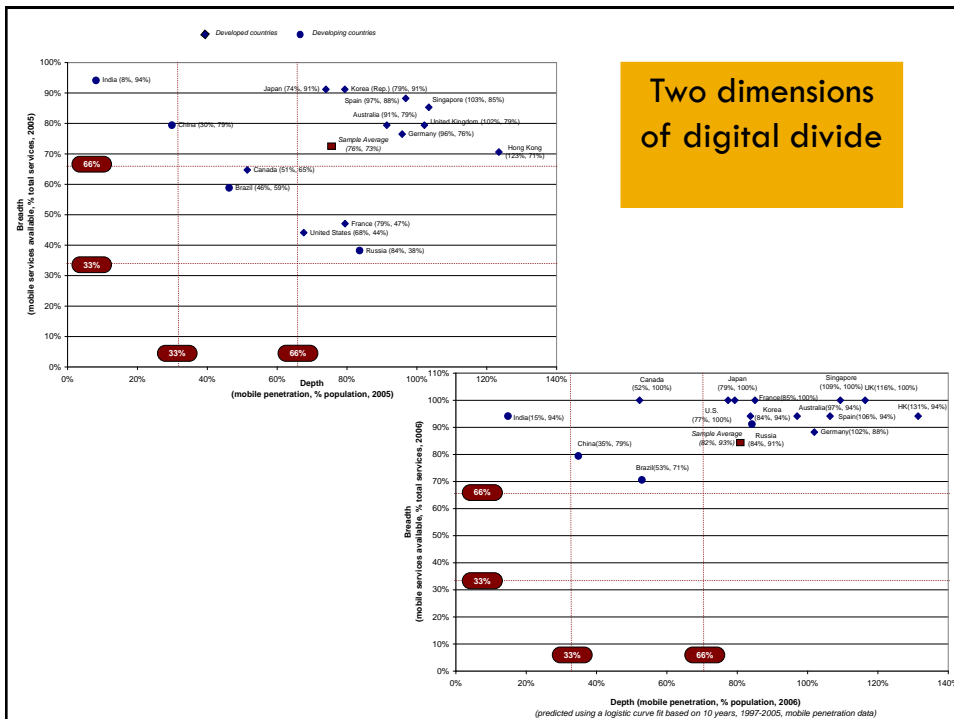
## Breadth Findings 2010 Update, Actual Usage

Service Breath (% mobile phone users, 2009)  
Source: BCC data



# Conclusion - Breadth

- Differences only for some, not all, years and mobile service categories in sample
  - ▣ We cannot conclude a digital divide on mobile technology service breadth actually exists
  - ▣ For mobile service breadth, BRICs have similar (or sometimes higher) levels vs. developed countries
- Possible reasons
  - ▣ Competition / government incentives
  - ▣ Lower costs for service infrastructure and acquisition
  - ▣ Handset developments
    - Price
    - Features



## Evolution Paths, 2005-2006

Mobile technology breadth level	Hi	India China →		Korea, Hong Kong, Singapore, Australia, Japan, Spain, United Kingdom, Germany
	Med		↑      ↑ Brazil, Canada	↑      ↑      ↑ USA, France, Russia
	Lo			
		Lo	Med	Hi
Mobile technology depth level				

## Conclusions (1)

- Broadening the digital divide definition captures more complex picture
  - Fast narrowing of mobile technology depth divide
    - high mobile technology depth levels possible (ex: Russia)
  - Little evidence of mobile technology service breadth divide
    - BRICs can have very high levels (ex: India)
    - BRICs leapfrogging with innovative mobile services
  - Some BRICs may be behind one dimension, but ahead on the other
  - High mobile service breadth can be achieved without similarly high mobile technology depth (or GNI/capita)

## Conclusions (2)

- Slow discovery cycle
    - Data 2005-6
      - Available 2007-8
        - Published 2009
          - Supported by independent (BCC) research (published end of 2010)
            - 2009 data
            - 2015 predictions
- Consistent results
  - ▣ Mobile phones as new technology platform for developing world

## Implications (1)

- Digital divide
  - ▣ Demonstrate need to broaden the definition
  - ▣ Service breadth does not seem to depend on structural variables
    - new theory needed
  - ▣ Service breadth implications → will mobile technology be a complement or substitute for other ICTs?
- International marketing
  - ▣ Different demographics, incomes, value definitions, consumer behavior patterns
- Innovation adoption and diffusion
  - ▣ Adoption definition: depth & breadth
  - ▣ Adopter unit focus: individual & group
- Information systems
  - Mobile phones as new technology platform for developing world
  - Mobile device design
  - IS application development
  - Impact on work practices

## Implications (2)

- New profit sources from developing world
  - ▣ Infrastructure
  - ▣ Devices
  - ▣ Applications and services
- New product and service innovation
  - ▣ Developed to developing or local adaptation?
- Technology transfer
  - ▣ Developing to developed
- Investing
  - ▣ Local and global companies
- Policy-making
  - ▣ Economic growth through locally-built, ground-level development
  - ▣ Encourage and financially support technologies with leapfrog potential
  - ▣ Data collection for better studies

## Questions



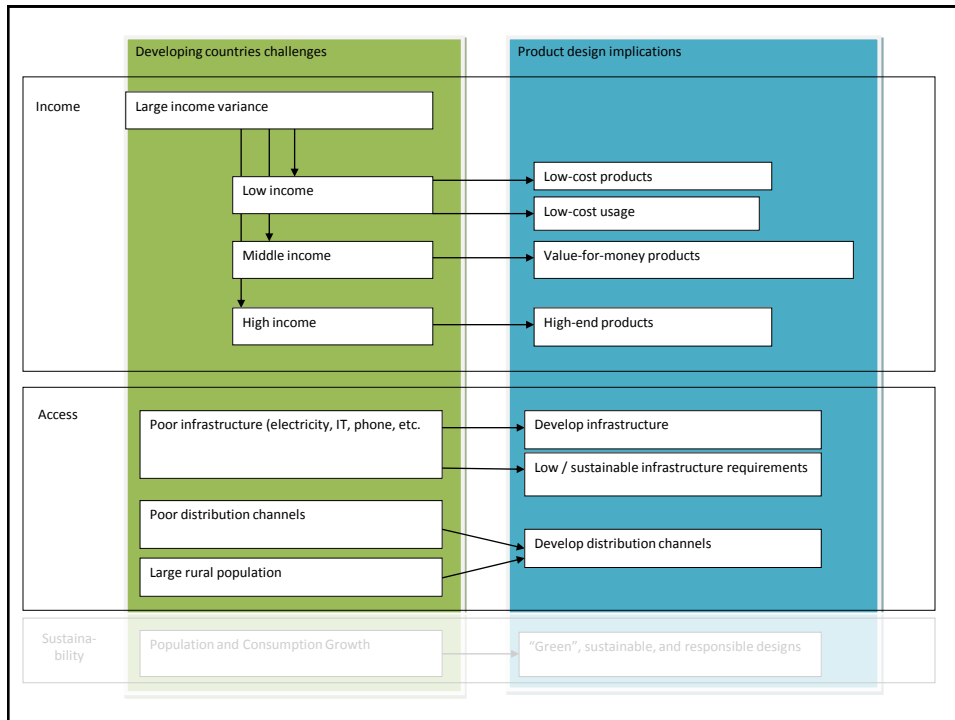
## MOBILE TECHNOLOGY DESIGN

Based on Alina M. Chircu and Vijay Mahajan, "Sustainable Design for Developing Countries: Lessons from the Mobile Phone Industry," Working Paper, 2011.

## Global Product Design

- Digital divide
  - Adoption of same technology (assumed)
  - Differences: economic, demographic, environment
- Marketing Strategy: Emerging Markets as natural laboratories
  - Adapt new product design and launch to local needs
  - Differences: Socioeconomic, cultural, regulative system
- Marketing Strategy: "Semiglobal"
  - Stages
    - initial decisions
    - market expansion (locally-adapted products, economies of scope)
    - global strategies (economies of scale)
  - Country groups
    - BRIC – individual
    - Next 11 – geographical proximity or affinity clusters

(Burgess and Steenkamp, 2006; Douglas and Craig, 2011; Hart and Christensen, 2002; Dewan et al., 2005; Crenshaw and Robinson, 2006; Kauffman and Techatassanasoontorn, 2006)



## Data

- Exemplary and revelatory case
  - Nokia
- Data
  - Interview data – design
  - Company reports 2007-2010: SEC filings, Sustainability, Corporate responsibility
  - News reports (db of articles, 1990's-present)
  - Industry associations reports
  - NGO reports

## Nokia – Profile

- Top manufacturer in the world, 2010
  - ▣ Nokia: 28.9 % market share (from 36.4% in 2009), 460K+ units
  - ▣ Samsung: 17.6% market share (from 19.5% in 2009)
  - ▣ LG Electronics: 7.1% market share (from 10.1% in 2009)
  - ▣ Others: 3% market share or less
- 600 facilities
  - ▣ 10 production sites: China, Brazil, India, Europe – western & eastern, Korea, Mexico
- Supply chain
  - ▣ 35 countries – developed & developing

## Nokia – Markets in 2010

- Net sales: EUR 42.4 billion (~ USD 55.9 billion)
  - 10 major markets, net sales (EURm)
    - ▣ China 7,149 (strong growth)
    - ▣ India 2,952
    - ▣ Germany 2,019
    - ▣ Russia 1,744
    - ▣ USA 1,630
    - ▣ Brazil 1,506
    - ▣ UK 1,470
    - ▣ Spain 1,313
    - ▣ Italy 1,266
    - ▣ Indonesia 1,157
- (source: Nokia.com , 2010 report)

## Manage Product Acquisition Costs

- Low cost:
  - ▣ Low-cost (under \$50) phones.
  - ▣ Shared usage features
    - multiple address books), cost and airtime-tracking features, and low-denomination refills and credit transfer features enabling pooled airtime purchase, a practice that has been documented in Uganda, Kenya, and other countries
    - → the average costs to own and operate a mobile phone in developing countries can be as low as \$11
- Middle income: additional features
- High end

## Acquisition Cost (India) (Source: Nokia.com)

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Nokia 1280	Nokia 2730 classic	Nokia 5030	Nokia 5130 XpressMusic
			
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Rs. 1,112*	Rs. 4,251*	Rs. 1,618*	Rs. 4,556*
<a href="#">Buy</a>	<a href="#">Buy</a>	<a href="#">Buy</a>	<a href="#">Buy</a>
~\$25	~\$95	~\$35	~\$100

Slide

Touch screen

Large screen (min. 2")

Full qwerty keyboard

**Key features**

Bluetooth

Internet browser with HTML

Email application

3G (WCDMA)

3G (HSPA)

FM radio

Music player (MP3)

Video recorder

Dual Sim

Camera megapixels

Select megapixels

**Advanced features**

Internet over WLAN

Speaker phone

Video playback













Push email support

GPS navigation

Global roaming support

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 Nokia C3 Touch and Type <a href="#">Add to compare</a> Rs. 8,613* <a href="#">Locate Store</a>	 Nokia E7-00 <a href="#">Add to compare</a> Rs. 29,999* <a href="#">Locate Store</a>	 Nokia C7-00 <a href="#">Add to compare</a> Rs. 17,734* <a href="#">Locate Store</a>	 Nokia C6-01 <a href="#">Add to compare</a> Rs. 16,721* <a href="#">Locate Store</a>
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Coming soon

**Product Portfolio:**  
Cost –  
Newest  
Releases,  
May  
2011  
(India)

(Source: Nokia.com)

~ \$672

~ \$49

## Increase Consumer Value

- All levels
- Low-end:
  - Reliability features
    - sturdy, shock-resistant bodies and dust-proof covers)
  - Value for money through add-on features
    - radio, flashlight, and noise-cancellation technology
    - camera, music player
 (some used extensively among villagers – ex. India)

# Cost and Value - Design (Source: Nokia.com)

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## Nokia 1280 Features

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 **Design**

-  • Communicate effortlessly using the large, simple keypad and tactile keys.
-  • Use every day - the anti-dust keypad and scratch resistant cover are built to last.
-  • Fit it easily into your pocket and take it anywhere with you.
-  • Personalise your phone with a range of exchangeable colour covers.
-  • Recognise who is calling with the personalised mp3-grade ringtones.



# Cost and Value - Services (Source: Nokia.com)

Ovi Life Tools is available in China





## Adopt Product and Customer Lifetime View

- Increasing levels of add-ons
  - ▣ Display and ringtone personalization
  - ▣ Memory
  - ▣ Messaging, multimedia features
  - ▣ Web, email, GPS and mapping features
- Quality focus
- Cover full range of buyer initial purchase and upgrade needs
  - ▣ Delight first-time buyers (lower-price first-time devices) → encourage subsequent purchases / upgrades to higher-price products
  - ▣ Quality phones resold on the secondary market at a lower price make more lower-income consumers aware of Nokia

## Lifetime View

- Low-end models: utilitarian features
  - ▣ Robust design, anti-slippery, dust and splash-proof, integrated flashlight, integrated radio, multiple use capability, easy sharing of the product, sound enhancement features, and noise cancellation
- More advanced models: hedonic features
  - ▣ Slim, brilliant display, game-enabled
  - ▣ Advanced functionality - conference calls, PC & Internet connections, speakerphone, pictures, video, SMS & MMS, and voice recording, as well as localization through languages, ring tones, localized games (i.e. cricket for India), and local calendars.
- Higher-end models: “aspirational” features
  - ▣ Sleek, elegant, trendy, refreshing, stylish, glossy, “pleasure to use” phones, “stand out from your peers” covers
  - ▣ Also emphasis on durability and functionality important for customers with limited incomes.

## Lower Operational Costs

- Manufacturing and design functions in developing countries
  - China
  - India
  - Eastern Europe
- High level of communality across devices
  - Fewer parts
  - Interchangeable parts
  - Local market customization

## Build Infrastructure & Eco-system

- Re-designe distribution network
  - away from national and towards more provincial and direct distributors
  - resulting in 90,000 points of sale in India and 40,000 in China
  - Nokia has 300+ vans providing product help in rural India
- Manage the product ecosystem - Local entrepreneurs
  - Charge phones for a fee using car batteries or small electricity generators (Uganda)
  - Sell top-off cards and charging services in Congo
  - Sell call-based access to 5,000+ Grameen and Nokia-sponsored "village phones" (Uganda)
  - Help deliver messages, mediate calls, and transfer money through mobile credit transfers in Uganda

## Infrastructure



Sources: BusinessWeek, India-Insights.co.uk

## Develop Green & Sustainable Products

- Product features
- Suppliers
- Customers

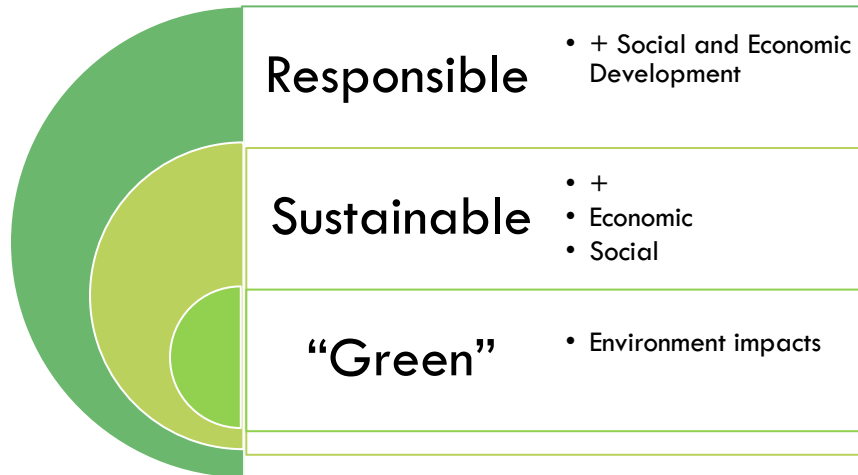
## MOBILE TECHNOLOGY SUSTAINABILITY

Based on Alina M. Chircu and Vijay Mahajan, "Sustainable Design for Developing Countries: Lessons from the Mobile Phone Industry," Working Paper, 2011.

### Sustainability – What? (part 1)

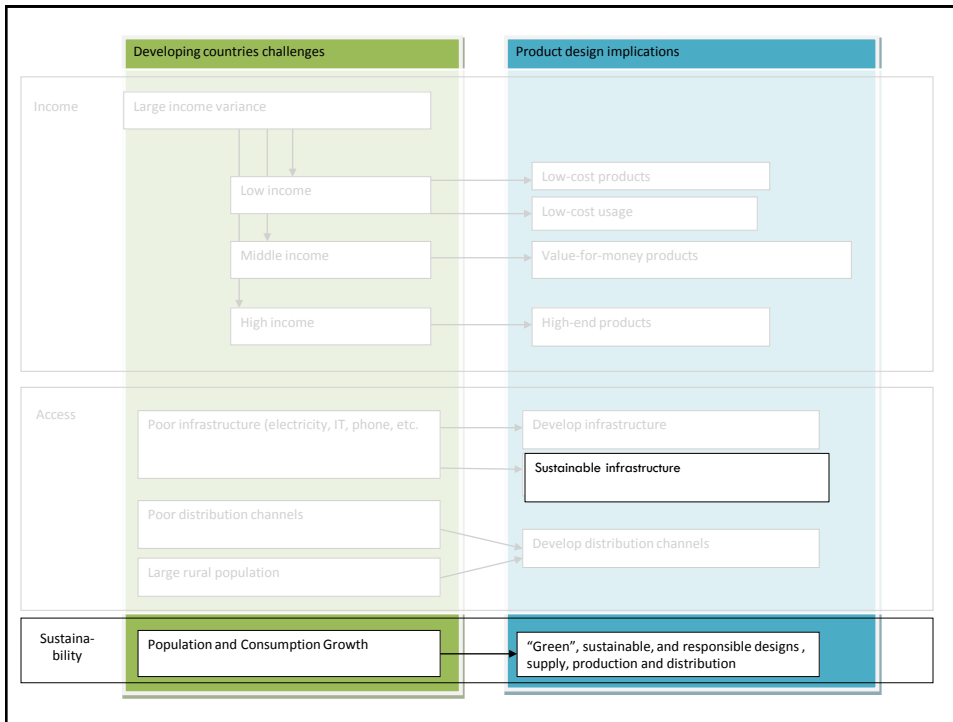
- World Commission on Environment and Development (1987): "meet the needs of the present without compromising the ability of future generations to meet their needs"

## Sustainability – What? (part 2)



## Sustainability – Why and How?

- Why?
  - Improve firm performance and competitive advantage (Carter and Rogers, 2008)
  - Customer pull vs. organizational push
- How?
  - Compliance → sustainable value chains → sustainable products & services design → new business models → next-practice platforms (Nidumolu et al., 2009)
  - Monitoring → logistical integration (info sharing) → tech integration (collab, joint design and reengineering, training) (Vachon and Klassen, 2006)
  - Awareness → investigation → determination → action (solution) → evaluation (solution) → proliferation (strategy implementation) → integration (org-wide solutions and technologies) → business opportunity (existing and new products/customers) (Elliot and Binney, 2008)



## Sustainability Findings

- **Supplier sustainability standards**
  - Comply to country-specific mandatory environmental regulations & voluntary company-wide rules across the supply network
  - Develop, monitor, enforce: requirements, self-assessment, on-site assessment (regular 2 yrs / in-depth)
  - Requirements: Code of conduct (corruption, business procedures, health and safety, human rights, working conditions, social rights and environmental standards): 92% meet requirements & Environmental management system & certification: 92% direct suppliers certified (ISO 14001) / 98% hardware purchasing
  - Self-assessments: 59 (12 corporate / 47 site specific) ; Assessments: 58 regular, 5 in-depth
  - Training (all) & collaboration (select suppliers)
- **Industry-wide and worldwide sustainability initiatives**
  - UN Global Compact, Global eSustainability Initiative (GeSi) & Electronic Industry Citizenship Coalition (EICC), International Labour Organization & UN human rights declarations, FTSE4Good and Dow Jones Sustainability Index
- **Logistics**
  - Minimizing the carbon footprint through third-party logistics providers
- **Facilities**
  - Minimize the use of water and energy, waste & promote renewable sources
- **Product Lifecycle**
  - Design for environment philosophy – closed loop, green product designs – different materials, better chargers, etc., minimize use of direct materials, especially those from non-renewable or toxic sources, in both products and their packaging
  - Take-back – 5,000 collection points
  - Consumer tools and education
- **Corporate social responsibility**
  - Promoting economic and social development – educational, civic, entrepreneurship, and health in communities along supply chain

## Sustainable Design

- Green: Design for environment, closed loop
  - ▣ use of different, less polluting or easier to recycle materials
  - ▣ building better chargers to reduce energy consumption
  - ▣ minimizing the use of direct materials, especially those from non-renewable or toxic sources, in both products and their packaging
  - ▣ end of the product lifecycle in both developed and developing countries.
    - take-back strategy with 5,000 collection points
    - consumer tools
    - education on recycling opportunities
- Sustainable ?
- Responsible ?

## Green Design (Source: Nokia.com)

You are here - [Nokia Europe](#) » [Find products](#) » [Accessories](#) » [All Accessories](#) » [Power & Data](#)

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SUPPORTING JAPANESE RED CROSS RESPONSE.  
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### Nokia Bicycle Charger Kit

Overview Features Gallery Specifications Compatibility

**Charge your phone with free and eco-friendly energy when you cycle**

Use your own pedal power to charge your phone for free, efficiently and reliably, when you cycle. This durable charging kit is a convenient way to make sure you can stay in touch.



**An efficient electricity supply** ▾

This charging kit is an effective way to generate power. Charging starts when you cycle at walking speed (6 km/h) or faster, and at 12 km/h it charges as efficiently as common Nokia mains chargers.

**Easy to install for more enjoyable cycling** ▶

**Durable and reliable** ▶

## Green Design (Source: Nokia.com)

Our environmental activities are based on lifecycle thinking. We are focusing on:

- using approved, tested and sustainable materials and substances in our products
- improving the energy efficiency of our devices, applications and enhancements including chargers
- developing smaller and smarter packaging for our products
- engaging people who use our devices via eco software and services and recycling



Our recently launched devices **Nokia N8**, **Nokia E7**, **Nokia C6-01**, and **Nokia C7** come with many of the latest sustainable and energy-saving features.

For example, they have been constructed using recycled and environmentally-friendly materials; include features like Power Save mode, OLED display, an 'Unplug charger' reminder, and an in-device e-guide (allowing us to supply reduced 'quick guides' in sales packages); and use the latest high efficiency chargers.

## Green Design Philosophy (Source: Nokia.com)

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Devices and services Recycling Partners Strategy and reports The power of we:

### Creating our products

- Life cycle thinking
- Environmental impact
- Materials and substances
- Energy efficiency

### Devices and accessories

### Energy efficiency

### Services

### Packaging

### It's easy to be green

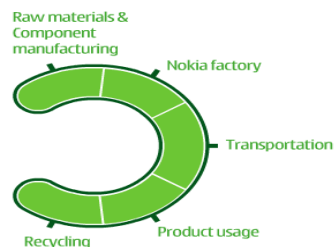
### Life cycle thinking

Our product creation is guided by life cycle thinking. It helps us continuously improve the environmental aspects of our products and processes in each phase of the product life cycle, from raw material acquisition till the end of life of the product.

We use life cycle assessment (LCA) for calculating the **environmental impact**, energy usage, and greenhouse gas emissions of our products and processes.

By identifying the largest sources of emissions and energy use over the lifecycle, we have already been able to take action in minimizing the environmental impact of our mobile devices.

To learn more about the improvements we have already implemented, please explore the life cycle demonstration below with your mouse pointer.



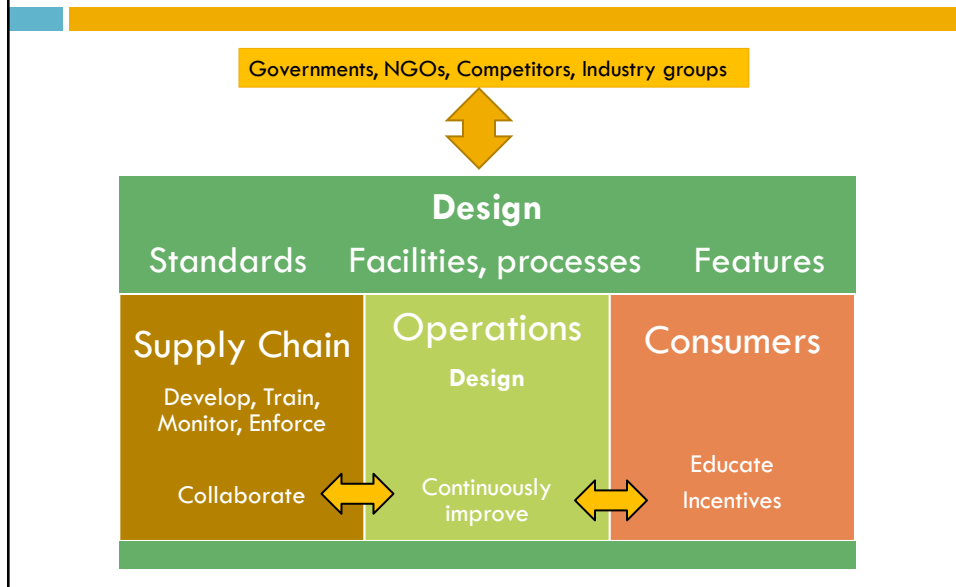
## Sustainability Findings vs. Existing Rsch

- Customer pull or **organizational push?**
  - ▣ Researchers believe in demand / pull, practitioners in pro-active orgs push (Seuring and Muller, 2008)
- Electronics industry
  - ▣ Most important - **supplier management, org involvement** (pro-active, design); less important - **recycling** (Hsu and Hu, 2008)
  - ▣ **External env management (suppliers), Internal env management, design, recovery** (econ incentives) (Zhu et al., 2005)

## Findings vs. Stage Models

- **Compliance as opportunity → sustainable value chains → sustainable products & services design** → new business models → next-practice platforms (Nidumolu et al., 2009)
- **Monitoring** → logistical integration (info sharing) → technological integration (**collaboration, joint design and reengineering, training**) (Vachon and Klassen, 2006)
- **Awareness → investigation → determination → action (solution) → evaluation (solution) → proliferation** (strategy implementation) → integration (**org-wide solutions and technologies**) → business opportunity (existing and new products/customers) (Elliot and Binney, 2008)

## Findings – End to End



## Implications

- New product and innovation management
  - ▣ Design principles
- Innovation diffusion
  - ▣ Multiple metrics, product and service-related
- Digital divide research
  - ▣ New platforms for developing countries
  - ▣ Leapfrogging
  - ▣ Work practices
- Policy decisions
  - ▣ Incentives
  - ▣ Additional services
- Business process change
  - ▣ Localized processes for design, production, marketing and distribution
  - ▣ Economies of scope and scale
  - ▣ Sustainability as opportunity

## Discussion

