

Emerging ICT Applications in Agribusiness Value Chains: Market Linkages, Food Security and Research Directions

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Presentation Outline

- * **Introduction**

- * Definition & Evolution
- * Global Revolutions & ICT Trends

- * **Objectives**

- * **Proposed Framework: ICT use in Agriculture**

- * **Emerging ICT Uses in Agribusiness Industry**

- * Drivers for ICT Market Linkages & Value Creation
- * ICT Impact Assessment - Household & Global Levels

- * **E-Challenges & Research Directions**

- * **Conclusion: Future Strategies**



So... what is ICT?

- * **One definition of ICT** is: an umbrella term that includes any communication device or application, encompassing: **radio, television, mobile phones, computers and network hardware and software, satellite systems** and so on, as well as the various **services and applications** associated with them, such as **video-conferencing and distance learning**. (Lewis, 2009)
- * ICT is simply an electronic means of **capturing, processing, storing and disseminating information** (Duncombe & Heeks)



So... why ICT?

- * ICT are meeting **information, communication, and knowledge** needs of farmers, agribusinesses, governments, and society.
 - * E-collaboration
 - * Distance neutral
 - * Interactive
 - * Mobility
 - * Market transparency



Different Types of ICT

Types of ICT	Types of ICT
Computers	Geographic Information Systems (GIS)
Mobile phones	Geographic Positioning System (GPS)
Smartphones- blackberries, i-phone, PDAs, etc.	Radio Frequency Identification (RFID)
Tablets, i-Pads, etc.	Video Conferencing
Lap-tops	Facebook
High Definition Television (HDTV)	Twitter
Voice over Internet Protocol (VoiP)	Blogs

Global Revolutions: Food and Agribusiness Implications

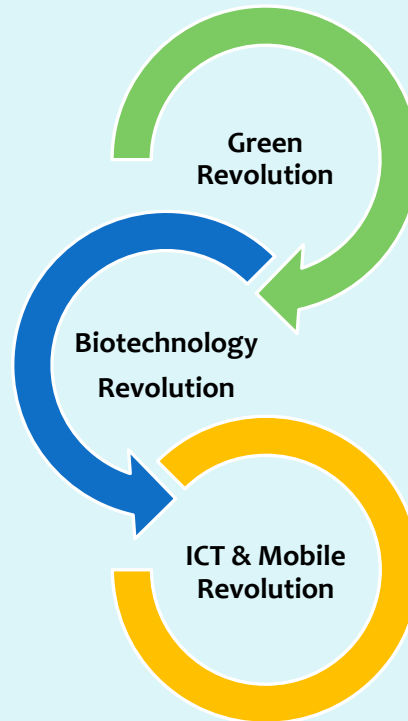
- * Industrial Revolution- *Early 1900s*
- * Green Revolution- *1960s & 1970s*
- * Biotechnology Revolution- *1990s and 2000*

Dawn of 21st Century?

- * Information & Communication Technology Revolution
- * Mobile Revolution: *2005 - 2010 & beyond*



Global Revolutions : Food Security Solutions?



Key Benefits of Revolutions

Revolution	Period	Benefits	Impacts
Green Revolution	1960-1970	Yield Enhancing Technologies	Better Nutrition Higher Per Capita Incomes Food Security
Biotechnology Revolution	1990-2000	Yield Enhancing Disease & Pest Resistance	Genetically Modified Foods Food Security/ Health Issues
ICT & Mobile Revolution	2000-2010	Access to Input & Product Markets	Market Information Systems ↓ Transaction Costs



ICT Advances in Developed Nations

- * **Electronic auctions** –livestock, cotton, etc.
- * **MarketMaker**- local food markets
- * **Agri-webinars** - dissemination of farm business management practices
- * **E-trading** - Electronic markets e.g. E-bay online trading
- * **E-retailing** - Amazon- online retailing
- * **Precision agriculture**- variable rate technologies (VRT), yield monitoring, field monitoring, soil sampling, etc.
 - * **Geographic Information Systems (GIS)**
 - * **Geographic Positioning Systems (GPS)**
- * **E-Pest Management Systems** - IPM systems

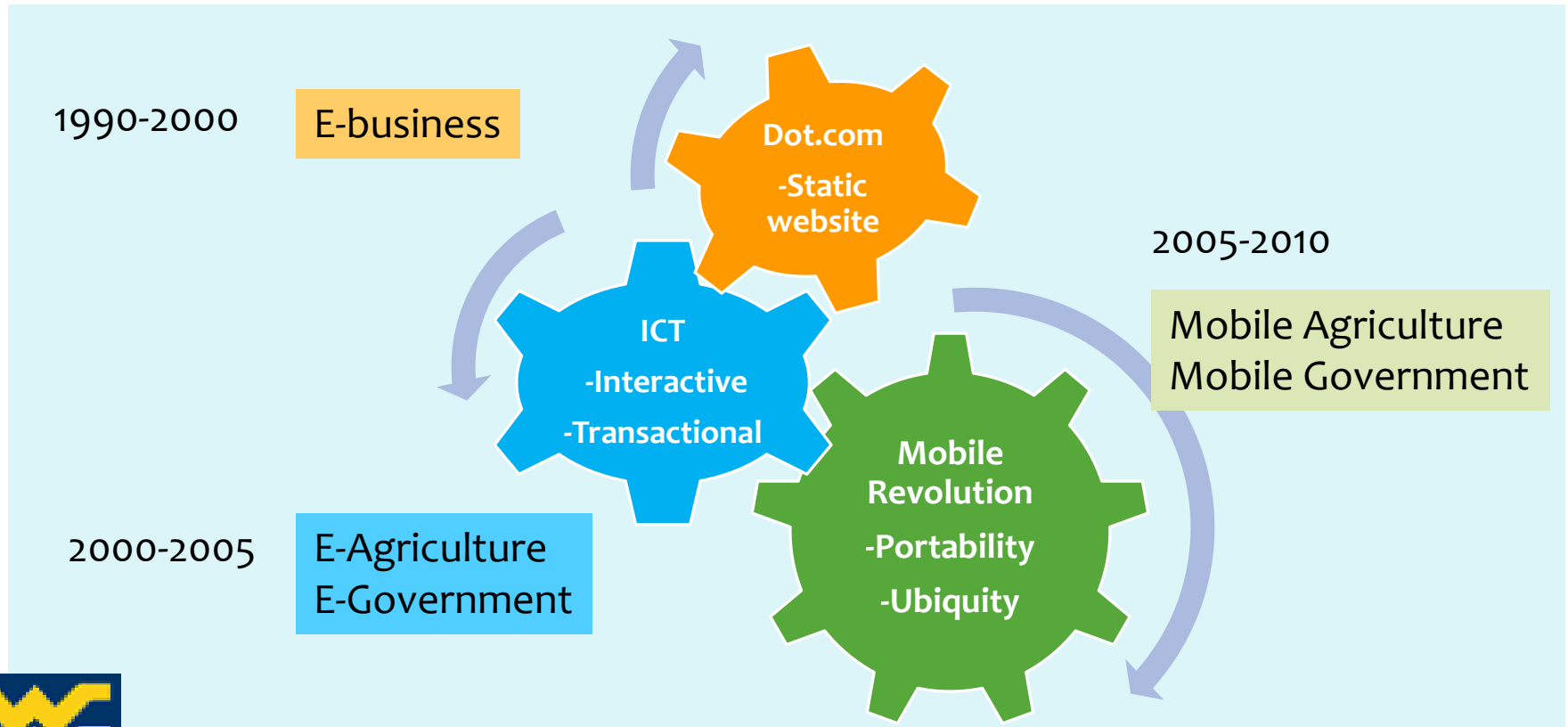
The Food and Agriculture Dilemma: Can ICT Make a Difference?

* Key Facts about Agriculture

- * World population will grow from **6.7 billion** to **9 billion** in 2050
- * Largest increases in **South East Asia** and **Sub-Saharan Africa**
- * **70 percent increase in agriculture** to feed projected population
- * **Climate change** threatening production stability and productivity
- * Real challenge is how to enhance **food security globally**
- * **Does ICT provide the means/solutions to escape poverty?**
- * **What ICT investments needed to improve food security?**



ICT Evolution in Agriculture



ICT Phases in Agriculture

Dot com
(Static Websites)

ICT-Digital
(Transactional)

Mobile
Revolution
(Convergence)

E-business



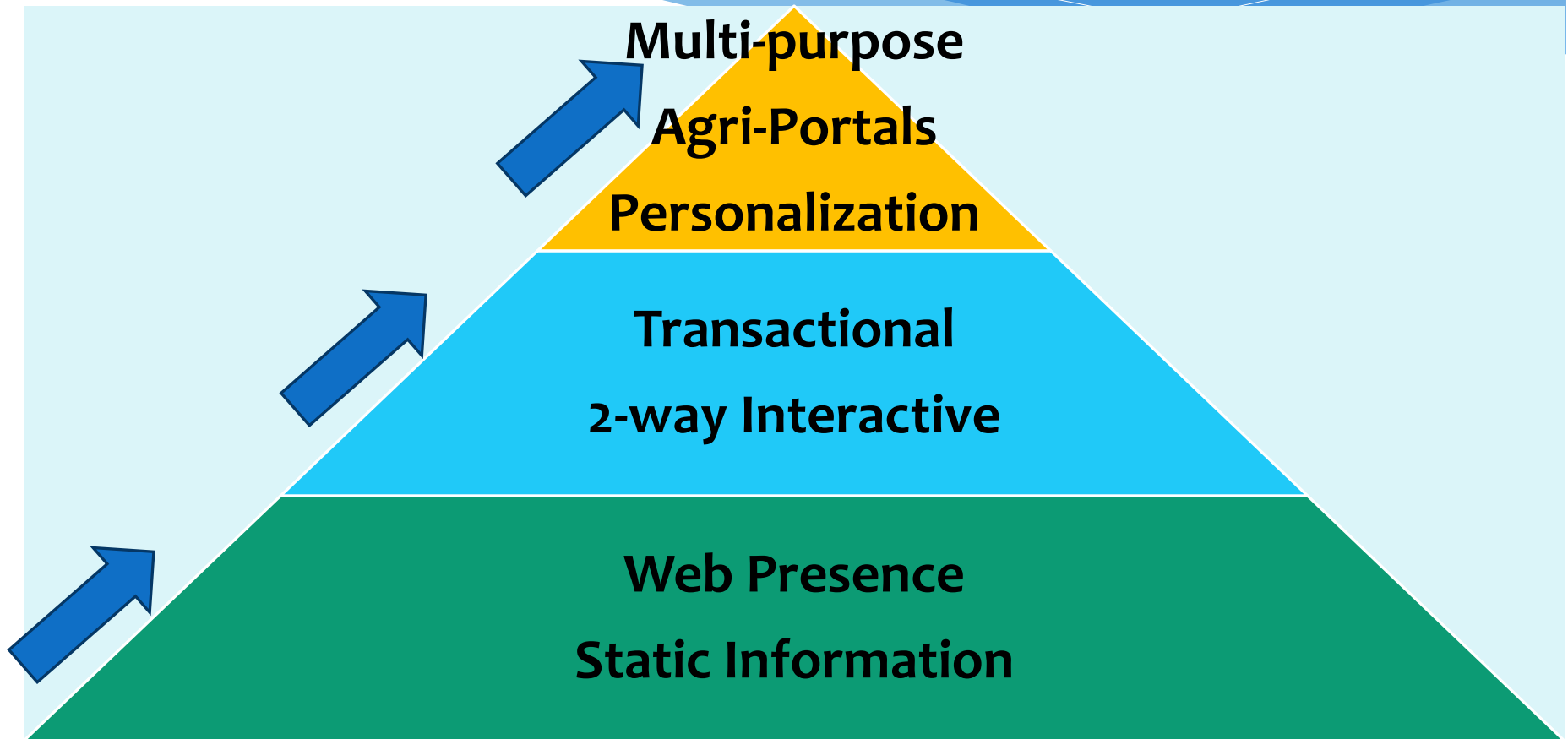
E-agriculture



Mobile Agriculture



Stages of ICT Integration in Agriculture



ICT Transformations : Business, Government and Society

Agriculture - Agribusiness

Mobile Agri-banking

Agri-food Marketing

Agri-tourism

Food Security

E-extension

Rural Development

ICT

E-Government

Mobile Government

Knowledge Society

Virtual Communities



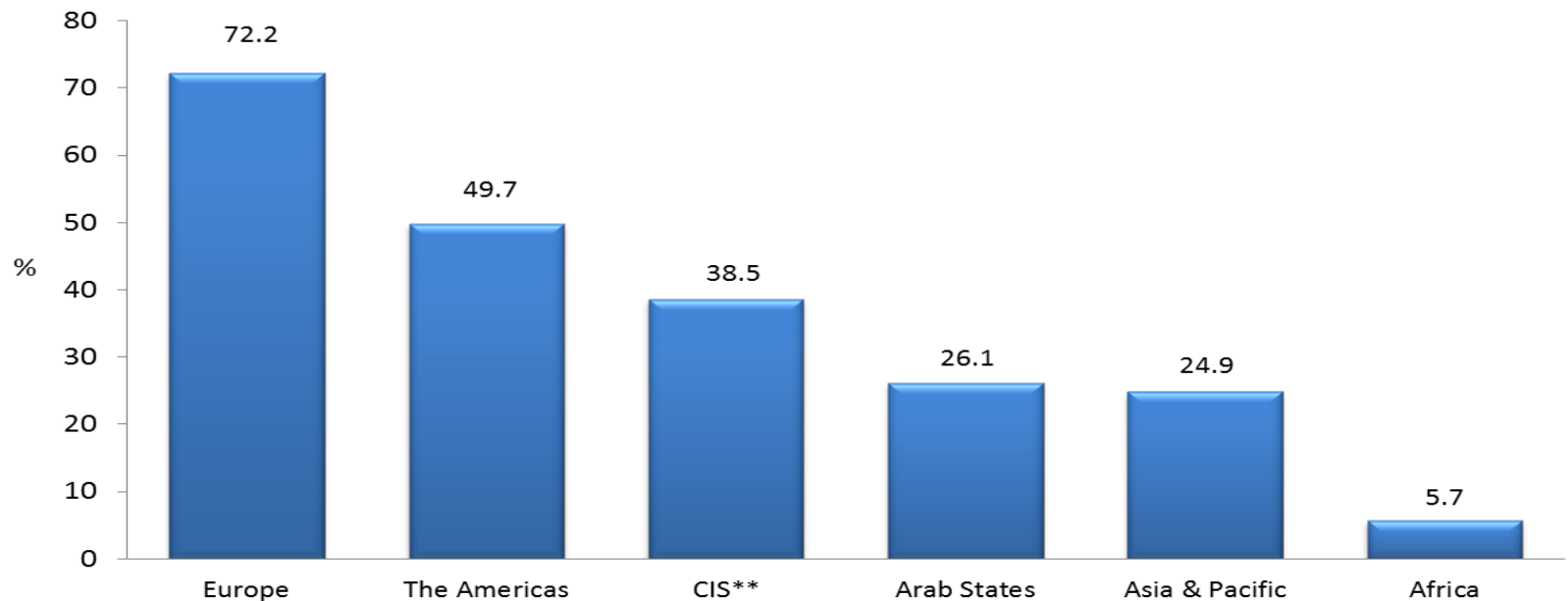
Key Global ICT Indicators

- * Internet users doubled 2006 to 2011
- * 35% world population on Internet
- * 71% of population in **developed** countries are online
- * 21% of population in **developing** countries
 - * Access to Internet *legal right* for citizens (Europe)
 - * Internet user penetration in Africa estimated at 9.6%
 - * 45% of world Internet users below *25 years old*



Household Internet Penetration

Proportion of households with Internet access, by region, 2011*



*Estimate

** Commonwealth of Independent States

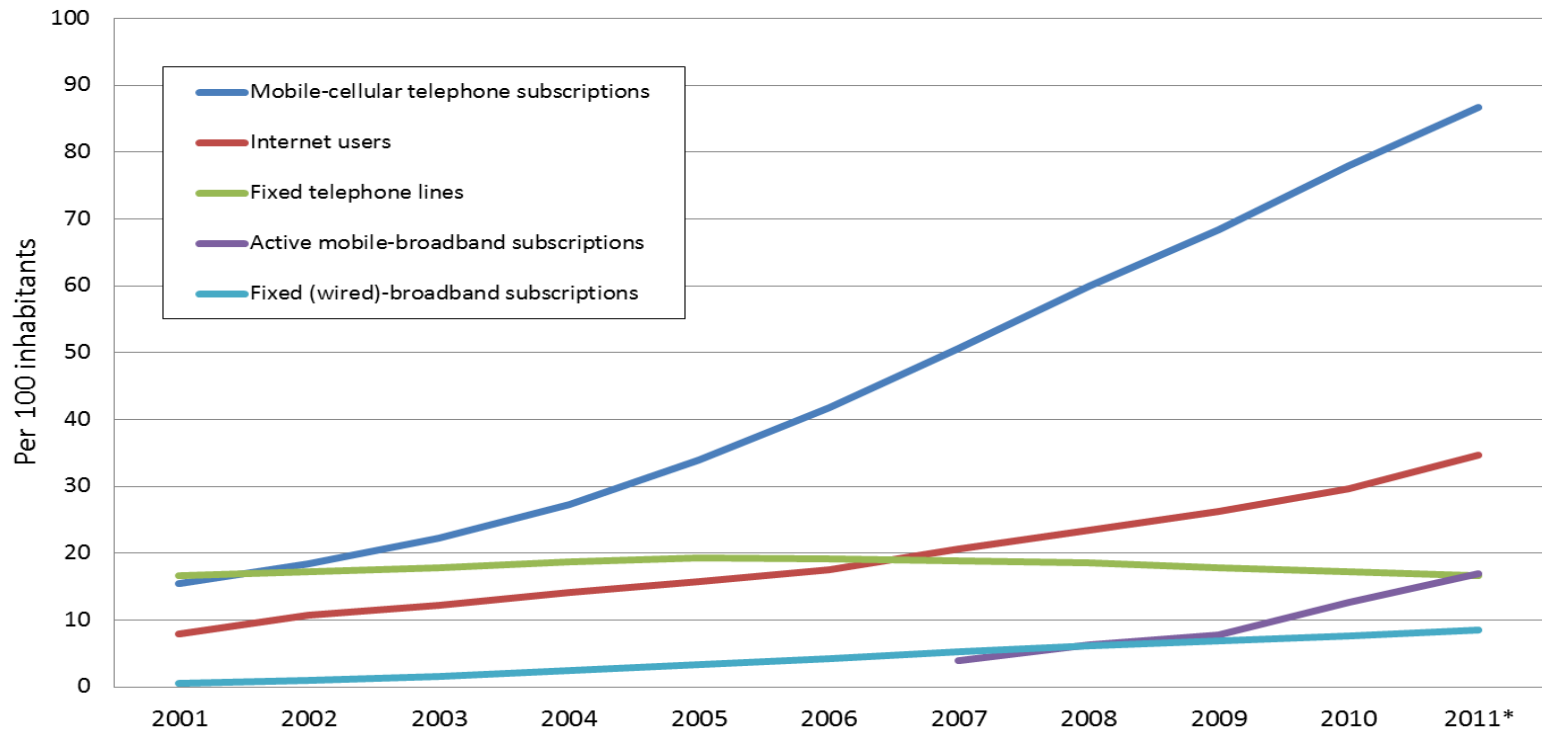
Regions are based on the ITU BDT Regions, see: <http://www.itu.int/ITU-D/ict/definitions/regions/index.html>

Source: ITU World Telecommunication/ICT Indicators database



Global ICT Trends

Global ICT developments, 2001-2011*



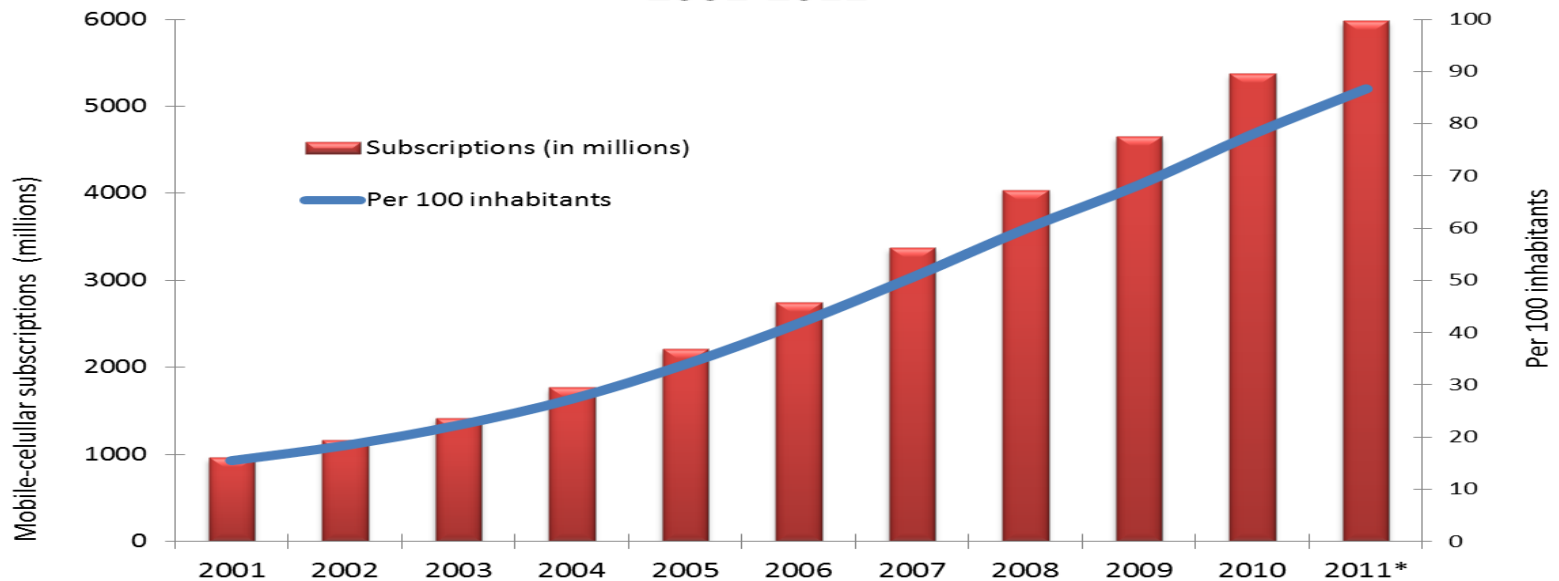
* Estimate.

Source: ITU World Telecommunication /ICT Indicators database



Global Mobile Cellular Subscriptions

Global mobile-cellular subscriptions, total and per 100 inhabitants, 2001-2011*



*Estimate
Source: ITU World Telecommunication /ICT Indicators database



Take-Away Lesson

- * Decade of unprecedented ICT growth
- * Growth driven by mobile technologies
- * 5.9 billion **mobile-cellular subscriptions**
 - * Global penetration 89%
 - * Developing world penetration 79%
- * Mobile Internet has huge development potential
- * Mobile-based agribusiness value chains untapped



Literature : Selected ICT Studies

ICT Area of Contribution	Authors & Year	Journal Publication
High labor productivity	Lio & Liu (2006)	J. of Ag. Economics
Lower transaction costs	Cordella (2006)	J. of Information Tech
Sustainability	Melville et al. (2010)	MIS Quarterly
Market access	Ackers (2008)	Univ. California Study
GDP growth	World Bank (2008)	Report
Consumer trust	Nowak &Newton(2008)	Int. J. Wine Bus Research
Poverty reduction	Kenny (2000)	Development Policy Review

Objectives

- * Describe **trends** in global ICT deployment with specific applications in agribusiness industry
- * Examine the potential **role** of ICT in enhancing farmer-market linkages, food security, and poverty alleviation
- * Identify key **challenges** in ICT uptake and utilization
- * Highlight current and future **research directions** in ICT in **agribusiness value chains** and **agriculture** in general



Framework: ICT in Agriculture

- * **Key Elements for Consideration:**

- * **Demand:** *new technology adoption*

- * **Supply:** *delivery channels- intranets, extranets, SMS/MMS*

- * **Value Creation:** *products & services*

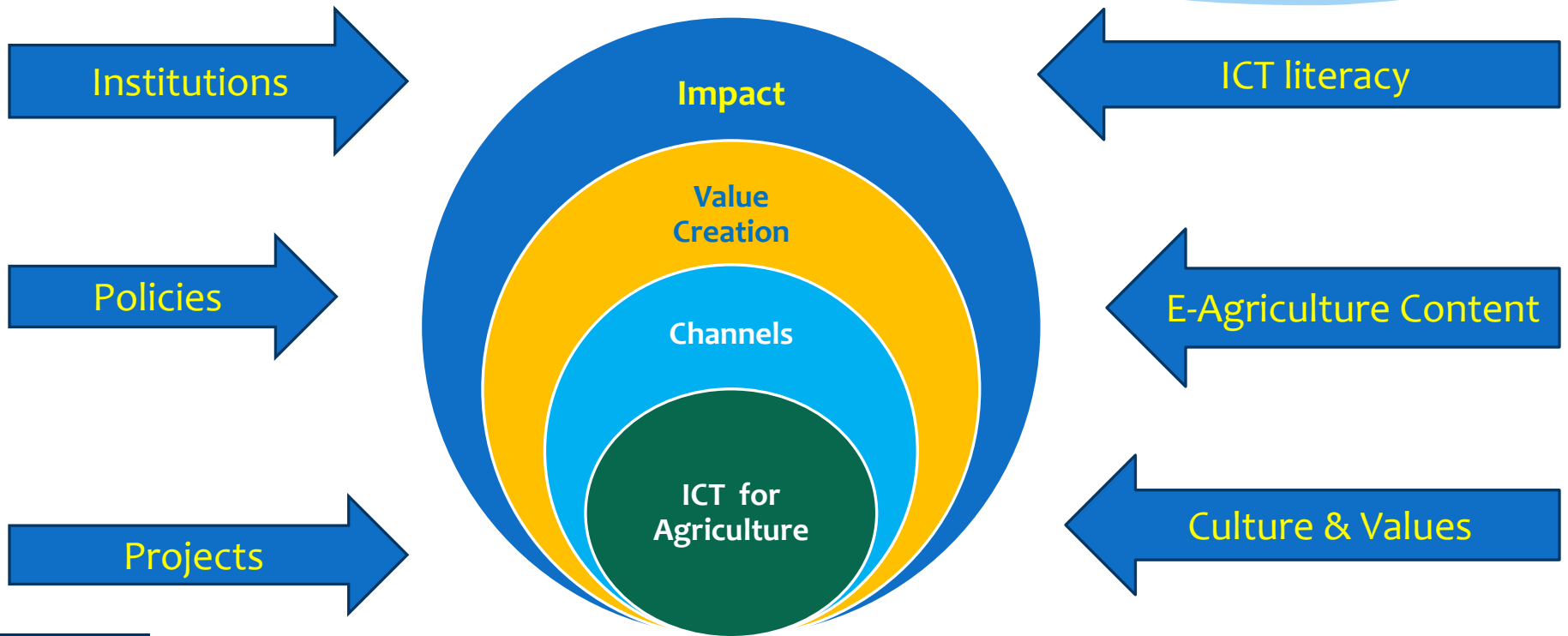
- * **Environment:** *Institutions & policies*

- * **Drivers:** *Societal benefits, consumer utility, values, culture*

- * **Effect:** *Impact Levels- food security, incomes, etc.*



Framework: ICT in Agriculture



Towards ICT Adoption Model

Mathematically:

$$ICT = f(D, P, LIT, LOC, VC, TU, CQ, RP, IM, z) + u$$

* Where;

ICT = Measure of ICT adoption (single/multiple ICT)

D = Technology delivery format – fixed/wireless

P = Technology price / Affordability

LIT = ICT literacy/ ICT numeracy/ Usability factor

LOC = Location (urban versus rural)

VC = Value creation in the chain (cost reduction, differentiation, reputation)

CQ = Content quality (availability of relevant content, context specificity)

RP = ICT regulatory policies and institutions

IM = Perception on positive/negative impact of modern ICT technologies

Z = Demographics (size, age, gender, experience, income, etc.)

U = Error term



ICT Uses in Agribusiness Value Chains: Market Linkages & e-Services

- * Applications in Agribusiness Enterprises include;
 - * Agri-tourism: *social media- promotion and marketing*
 - * Agri-banking: *mobile banking and remittances*
 - * Agri-Hubs: *e-services for farmer groups, food banks, etc.*
 - * Food Traceability: *e-supply chains, product recalls, etc.*
 - * Online Farmers' Markets: *e-ordering and delivery*



Driving Forces in ICT Market Integration

- * **Social media use** - *global market penetration (demand pull)*
- * **Rapid technological advances** - *GSM, 3G to 4G networks (supply push)*
- * **Discovery of new sources of competitive advantages** – *procurement, promotion, logistics, marketing*
- * **Pursuit of first mover advantages** - *innovative entrepreneurs, creativity, etc.*
- * **Need for real time engagement**- *suppliers, rivals, customers, etc.*
- * **Need for value chain coordination**: *e-procurement, e-marketing, e-distribution, e-promotion, & post-purchase e-services*



e-Value Creation in Agribusiness: Product & Service Transformations

* **Automation of Farm Production**

- * E-record keeping, e-budgeting, e-tax management, etc.

* **Access to Market Information Services**

- * DrumNet –Kenya- *increases bargaining power-market prices*
- * MarketMaker- USA- *enhanced access to market information-wineries*

* **Food Supply Chain Traceability**

- * Bar coding- wines/citrus fruits – orchards to global markets
- * Radio Frequency Identification (RFID)- bar coding, tracking systems
- * Geographic Positioning Systems (GPS)- fleet management

* **Customization of e-Agriculture Services**

- * Mobile banking –Wizzit (>16 million SA), m-PESA (9 million Kenyans),
- * e-Insurance - crop risk management, crop monitoring, etc.
- * On-farm livestock diagnostics, e-health service delivery for farmers



Impact of ICT in Agriculture?

* **Impact Assessment: Household and National Level**

- * Resolving Market Failure: *access to food and financial markets*
- * Agriculture Commercialization – *new creative enterprises*
- * Climate Change Management – *new early warning systems*
- * Food Security Improvements- *income growth, food access, etc.*
- * Development of Knowledge Society- *closing talent gap?*
- * Rural Poverty Alleviation- *ICT-based solutions, nutrition, etc.*
- * Value Chain Performance- *regional/global market integration*



Agriculture e-Challenges

- * **Mobile subscription is slowing-** *reaching saturation levels*
- * **Institutions & policy implementation lags-** *policy & incentives*
- * **ICT affordability** – *airtime, Internet café charges, etc.*
- * **Irrelevant e-content** – *not context specific/language barriers*
- * **Poor infrastructure-** *low transmission signals, load shedding*
- * **ICT training & awareness** – *technology keeps evolving*



Agriculture e-Challenges

- * **Customization**- meeting specific user needs, personalization?
- * **Local culture** – voice, text messaging, vernacular, generation?
- * **Information overload**- knowledge society, sorting costs, etc.
- * **Information credibility**- accuracy, reliability, misinformation, etc
- * **Training users** - effective use, sustainability, optimal use, etc.



ICT Challenges in West Virginia

- * **Availability of broadband and Internet connectivity**
- * **Need to enhance functional ICT literacy**
- * **Lack of agri-tourism mobile applications**
- * **Low awareness of tax credits for ICT deployment**
- * **Lack of virtual collaborative communities**
- * **Weak social media uptake in rural agribusinesses**



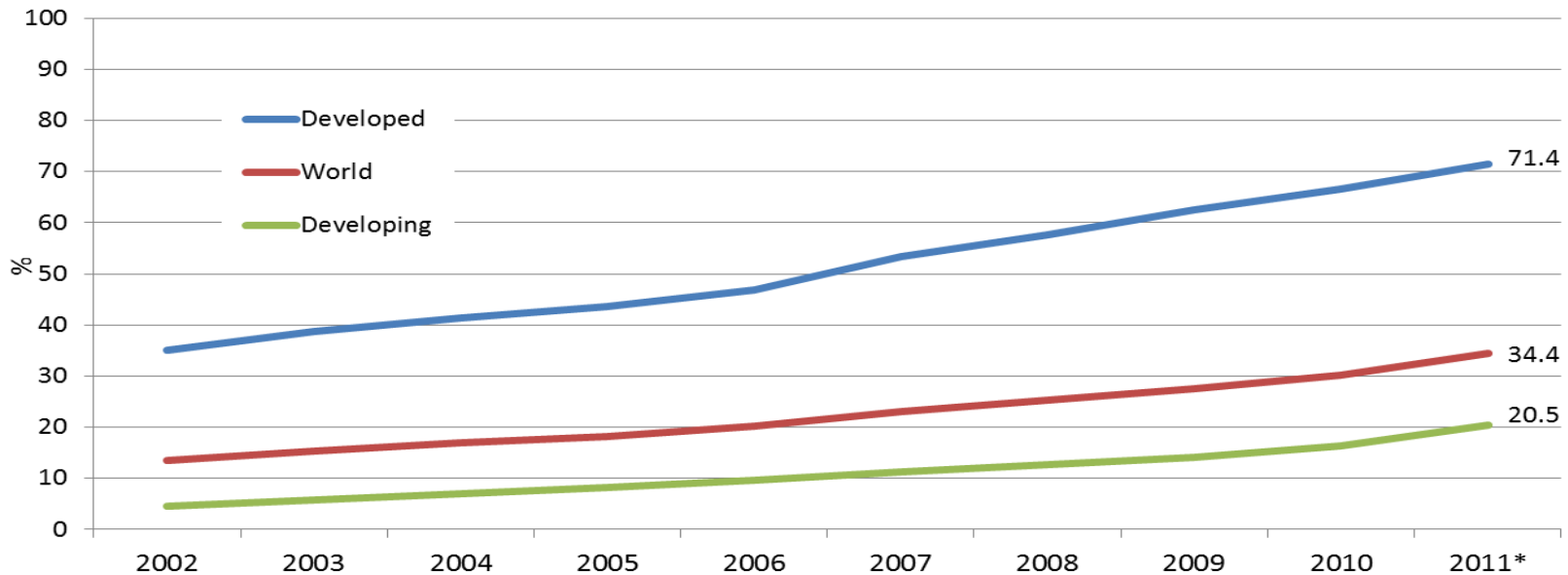
Relative Ranking of West Virginia in Internet Access and Number of Service Providers

State	Number of Internet Service Providers	Percentage of Population with Broadband Access
Kentucky	23rd	43 rd
Maryland	32nd	6 th
Ohio	7 th	26 th
Pennsylvania	14 th	12 th
Tennessee	25 th	46 th
Virginia	19 th	17 th
West Virginia	45 th	48 th



Digital Divide: Challenge and Future Market Potential

Proportion of households with Internet access by level of development, 2002-2010



*Estimate

The developed/developing country classifications are based on the UN M49, see:

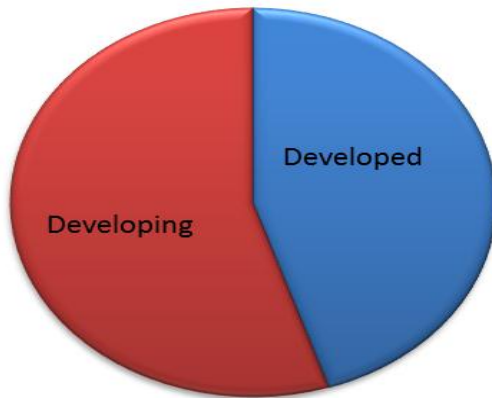
<http://www.itu.int/ITU-D/ict/definitions/regions/index.html>

Source: ITU World Telecommunication /ICT Indicators database



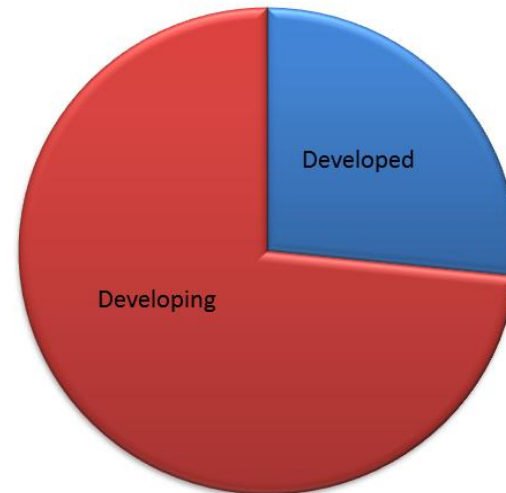
Mobile Subscription & Potential for Mobile Commerce in Agribusiness

Mobile-cellular subscriptions,
by level of development
2005



Total 2.2 billion

2011*



Total 6 billion



Multidisciplinary ICT Research Opportunities

- * **Information and Communication Technology for Research and Development in Africa (IJICTRDA)**
 - Multi-disciplinary focus
 - Relatively new- timely
 - Shared knowledge
 - Teamwork- International Editorial Review Board
 - Creative and innovative



ICT Uses in Agribusiness Value Chains : Research Directions

* International Journal of ICT Research & Development in Africa

- ICT applications in following areas;
 - *agriculture market information systems*
 - *modern farm production techniques*
 - *rural farm extension services*
 - *agribusiness enterprise development*
 - *agricultural financing & money transfer services*



Research Findings: IJICTRDA - 2010-2011

Research Topic	Country	Key Findings	Focal Area	Author(s)
Framework for Analyzing ICT on Agriculture Commercialization & Food Security	Kenya	ICT promotes food security ICT improves household food security	Agriculture commercialization & food security	Okello, et al, 2010 IJICTRDA, Vol. 1, Issue 1
Transformative Potential of Agricultural Mobile Information System in Tamilnadu	India	Mobile MIS deliver critical market price information to farmers.	Access to Market Information	Priya & Mathiyalagan, 2012 IJICTRDA, Vol. 3, Issue 1
Mapping the Distribution of Tsetse Flies	Uganda	Demonstrates changes in land use and land cover between 1986 and 2001. Identifies suitability of land cover for tsetse fly habitation	GIS and Remote Sensing applications in mapping tsetse habitats	Nakato et al, 2010, IJICTRDA, Volume 1, Issue 2



Research Findings: IJICTRDA - 2010-2011

Research Topic	Country	Key Findings	Focal Area	Author
Role of ICT-based MIS in Food Market Integration	Malawi	ICT increases spatial market integration ICT enhances efficiency of rice markets ICT improves food security	Farmer access to MIS Malawi Agricultural Commodity Exchange	Katenengeza et. al, 2011 IJICTRDA, Vol. 2, Issue 2
Role of Market Information in Adoption of Agricultural Seed Technology	Uganda	ICT-based MIS had positive impact on (i) output prices, (ii) adoption of improved maize varieties	ICT-based Market Information System (MIS) and linkages to food security	Kiiza et al, 2011 IJICTRDA, Vol. 2, Issue 2
ICT Policy for Agriculture based on Transaction Cost Approach	Sri Lanka	ICT can reduce high transaction costs Promotes agriculture commercialization	ICT and Transaction Costs	Harsha de Silva, 2010 IJICTRDA, Vol. 1, Issue 1



ICT Research Opportunities in Agribusiness and Agriculture Development

Agribusiness Focal Area	E-Value Creation & e-Services Development	Research Themes Issues & Innovations
Agriculture Financial Markets	Mobile banking- unbanked Mobile remittances	Diffusion of money transfer services Factors affecting access to input markets
Food and Agricultural Marketing	Mobile marketing Web-based service Internet marketing	Mobile market segmentation strategies Target marketing strategies Customer orientation- new generation
Agriculture Knowledge Management	E-agriculture forums E-extension support Local weather ; e-news	Use of new ICT-based early warning systems Food security, poverty alleviation Cyclone, tsunami warnings
Agribusiness Risk Management	Mobile –based portals Risk minimization	Diffusion of climate smart practices, e-insurance innovations strategies



ICT Research Opportunities in Agribusiness & Agriculture Development

Agribusiness Focal Areas	ICT Value Creation	Research Themes Issues & Innovations
Agri-tourism Enterprise Competition	MarketMarker Agri-tourist mobile guide Customer engagement	E-service delivery Destination branding Strategic role of social media
Agribusiness Competitiveness	ICT sustainability Transaction costs	E-waste management CSR & 3BL assessments
Food Traceability Food Safety	Radio Frequency Identification (RFID), GPS	E-agriculture supply chains Identity preservation studies
Quick Service Restaurant (QSR) Industry	Mobile commerce Strategic partnerships E-collaboration	Consumer WTP studies ICT adoption & diffusion Strategic market positioning

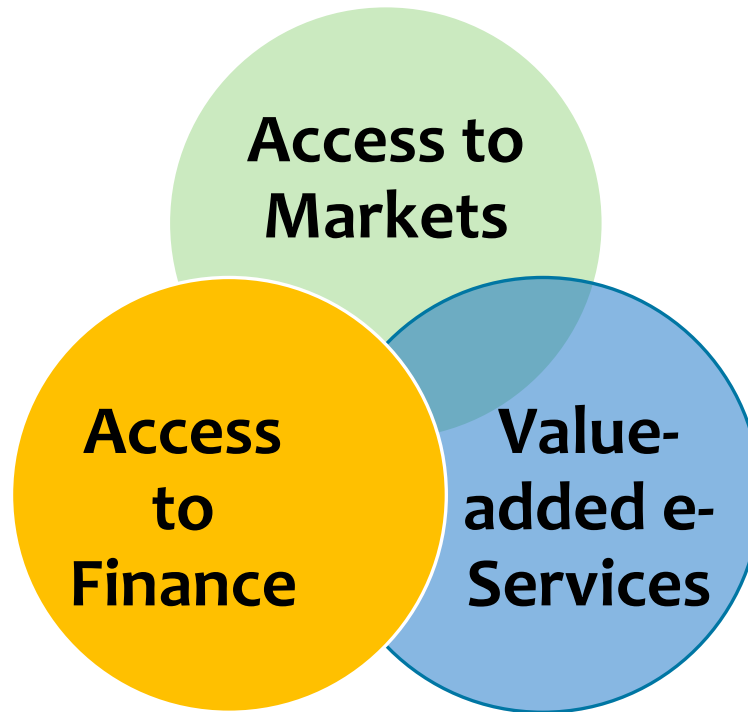


Future Research Directions

- * **Economic analysis** of using **ICT & social media** to enhance **marketing strategies** and **consumer market awareness**.
- * Assess the effects of emerging ICT (e.g. **cloud computing, 4G networks**) in **managing** modern **agribusiness value chains**.
- * Analyze the role and contribution of ICT in the development of both **adaptive** and **reactive strategies** in **climate change**.
- * Analyze role and impact of **mobile-based portals** for **agri-tourism, food traceability**, and other **specialized services**.
- * Assess **competitiveness** and **sustainability** of **ICT-based agribusiness value chains** – market positioning strategies



ICT in Agribusiness Industry: Research Niche Areas



Conclusion

- * High potential for ICT integration in agribusiness value chains
- * ICT increase market opportunities, minimizes risks, enhances information sharing, and real time collaboration.
- * ICT innovations in agribusiness industry and agriculture development;
 - * **Multi-dimensionality** of ICT- *input, products, services, etc.*
 - * **Ubiquity** of ICT- *everywhere, everyone, distance neutral, etc.*
 - * **Scalability** of ICT- *replicated across geographic regions*
 - * **Diverse impacts** -*social, economic, political, technological, etc.*
 - * **Multiplier effects** in ICT uptake- *agriculture commercialization, food security, climate change, value-added services, etc.*
- * **Full potential of ICT** remains untapped, but *key research niche area.*



Further Issues for Considerations

- * Managing literacy and growing expectations
- * Customization & convergence- technology/services
- * Security risk considerations for agriculture community
- * Privacy and confidentiality issues- cyber-security
- * Long-term sustainability of ICT initiatives



Thank You!

For Listening.....!!

Questions ?

