



Space Sciences for the Benefit of Society

Dr. Pascal Michel, Canada

United Nations/United Arab Emirates High Level Forum

“Space as a driver for socio- economic sustainable development”, November 20-24, 2016, Dubai, United Arab Emirates

Technology and human needs

“Stop seeing the world through the lens of technology, and start seeing technology through the lens of deep human needs and wants”

David Mattin, Trendwatching.com

business
life

Fundamental human needs

→ Subsistence – protection – affection – understanding - participation
Leisure – creation – identity - freedom

The World we live in - seven billion and counting

A growing population

By 2025, world population will be over 8 billion people. Around 2040 it could hit 9 billion and by 2100 it could reach a massive 11 billion people.

And a much bigger world economy

The world economy could grow a massive 26 times in this century. This will put enormous pressure on Earth's resources. And we are already overusing at 160 percent...

Current World Population

7,463,166,235

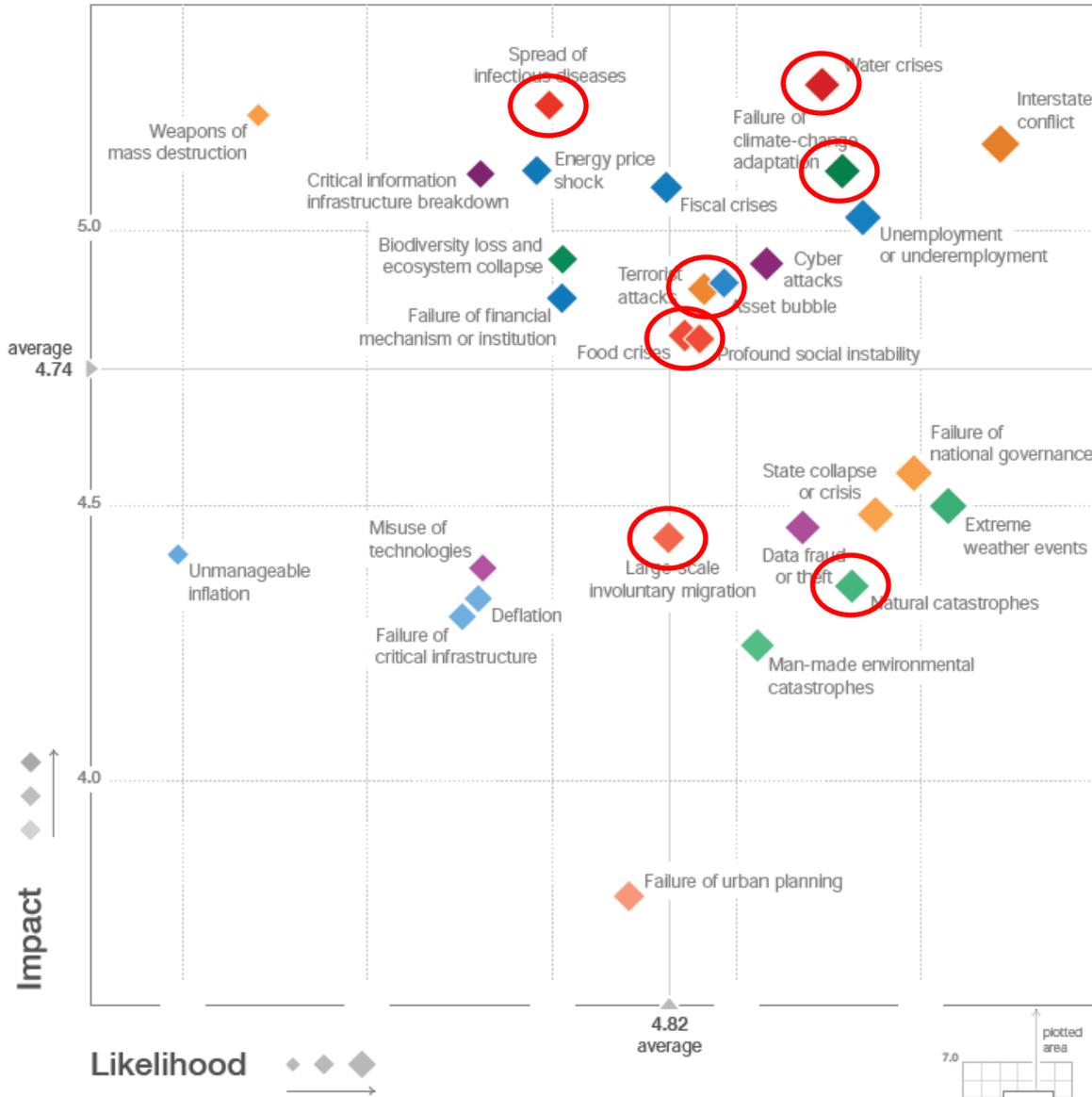
[view all people on 1 page > \(/watch/world-population/\)](/watch/world-population/)

TODAY	THIS YEAR
Births today 177,438	Births this year 122,913,001
Deaths today 74,306	Deaths this year 51,472,612
Population Growth today 103,132	Population Growth this year 71,440,389

www.worldometers.info
On November 9th, 2016



Global risks landscape - 2015



Trends 2015

- Ageing population
- Climate change
- Environmental degradation
- Growing middle class
- Increasing national sentiment
- Increasing polarization of societies
- Rise of chronic diseases
- Rising of mobility
- Rising income disparity
- Shifts in power
- Urbanization

Sustainable Development Goals



“International cooperation is a necessary driver for bringing the growing number of benefits derived from space science and technology applications to both developing and developed countries in their common pursuit of attaining the objectives of the global development agenda beyond 2015”

Simonetta Di Pippo, Director, UNOOSA, 52nd Session UN-COPUOS



Benefits from space – societal areas



Based on key words and proportional to Google search results, October 2015

Societal benefits from space exploration

Innovation

Contributed to many diverse aspects of everyday life (solar panels, heart monitors, cancer therapy) - an essential driver for opening up new domains in science and technology (materials, power generation, energy storage, waste management, advanced robotics, computing, miniaturization)

Culture and inspiration

A unique perspective on humanity's place in the Universe - Fulfilling people's curiosity, producing fresh data about the solar system : What is the nature of the Universe? Is the destiny of humankind bound to Earth? Are we and our planet unique? Is there life elsewhere in the Universe?

Addressing global challenges

A global endeavor contributing to trust and diplomacy between nations, advancing international preparedness on various issues such as asteroid strikes, space weather and space debris.

“There is no activity on Earth that matches the unique challenges of space exploration”



Societal benefits of space exploration spinoffs



Fuel-cell engine



Biosensor to test for pathogens



Algae-derived ingredients



Water mapping technology



Eurobot Wet Model



Canadian Space technology helps breast cancer patients



Chlorophyll meters detecting plant stress



Magnetic fluids for speakers



- 1.5 ml standard centrifuge Eppendorf tubes
- Sample re-use mode
- Built-in cleaning and decontamination modes

Societal benefits from the International Space Station

Human Health

Robotic arm for medicine - Preventing bone loss – Understanding Ageing – Growing high-quality protein crystals - vaccine development – Ultrasound – Immunology - Cancer treatment delivery – Supporting water purification

Earth Observation and Disaster Response

Monitoring water quality – Monitoring natural disasters - Supporting studies relevant to climate change - Keeping watch on the world's sea traffic

Global Education

Inspiring youth - students fitness - STEM



http://www.nasa.gov/mission_pages/station/research/benefits/index.html



Societal benefits from international cooperation



A UN-COPUOS session



AT6 international workshop on global health and space



Societal benefits from satellite services

Civilian satellites

- Communications



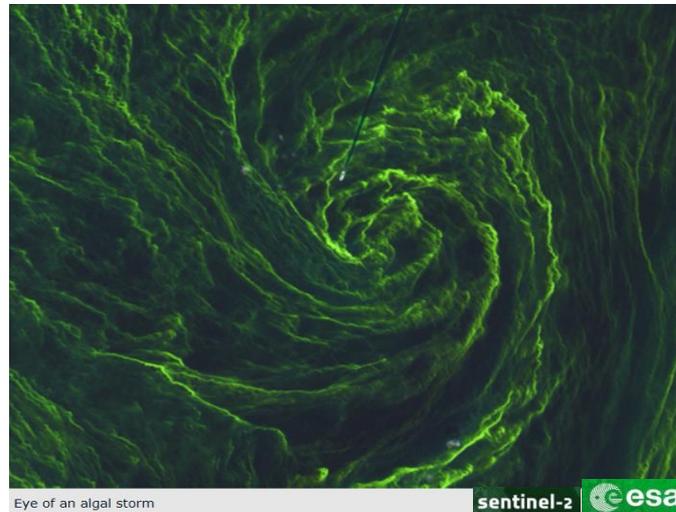
GLONASS constellation



Satellite Internet access via VSAT in Ghana

- Navigation

- Earth Observations



- Astronomical



Echo of Light from Hubble

Societal benefits from satellite communications

Satellite communications are essential for:

- Television from geostationary satellites
- For education, health, development and safety goals in remote areas or areas lacking terrestrial infrastructures
- For communications in the high seas, for planes and ships
- Lifesaving services, emergencies, disasters and peacekeeping

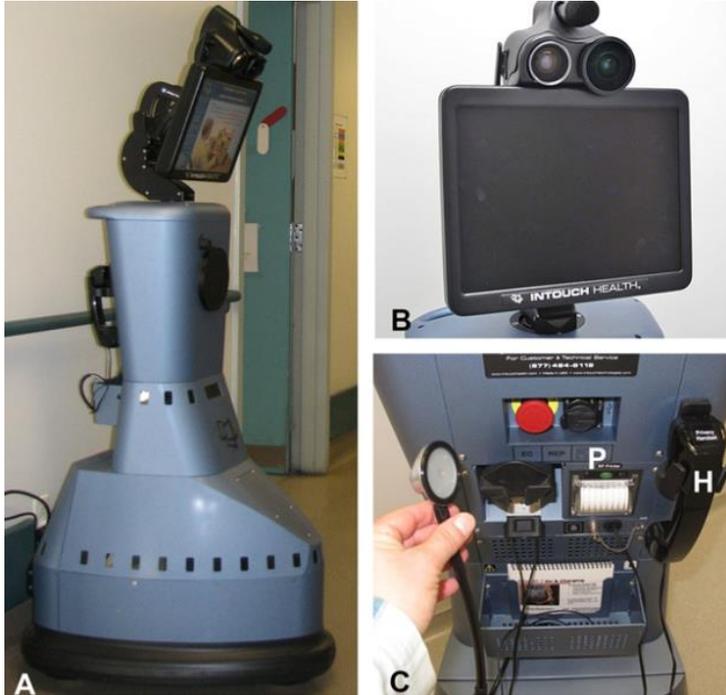


satellite services and applications

→ A VITAL CORNERSTONE OF MODERN SOCIETY



Illustration – telemedicine



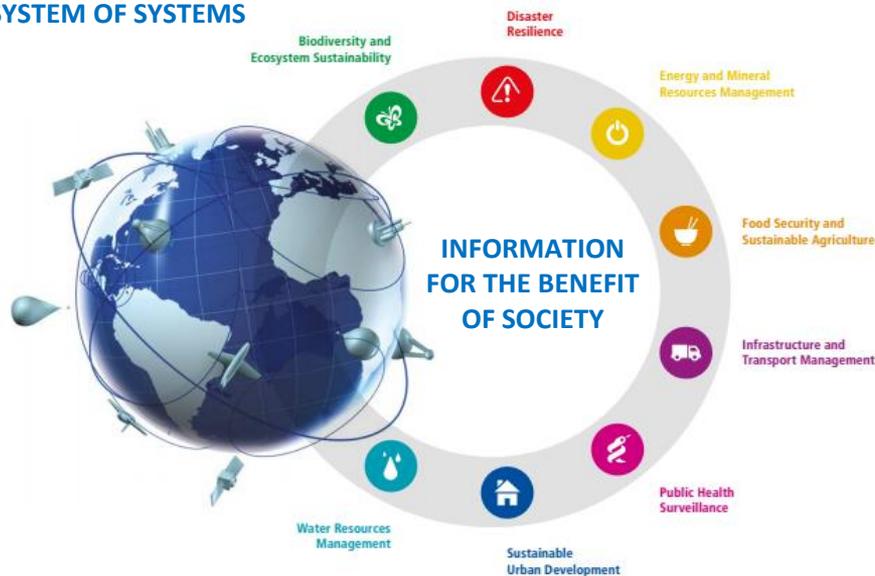
"Doctor in a Box"

5 ways robots are delivering health care in Saskatchewan

Dr. Ivar Mendez says robotic and portable devices represent start of 'revolution' in health system

Societal benefits from Earth observations

THE GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS



World Space Week 2014. © World Space Week Association, All Rights Reserved

- **Biodiversity and Ecosystem Sustainability:** Strengthening conservation, restoration and sustainable use
- **Disaster Resilience:** Increasing capacity to prepare, forecast, mitigate, manage and recover from disasters
- **Energy and Mineral Resource Management:** Facilitate sustainable increases in renewable energy
- **Food Security and Sustainable Agriculture:** Achieving food security and promoting sustainable agriculture
- **Infrastructure and Transport Management:** Minimizing environmental impacts towards a low-carbon footprint
- **Public Health Surveillance:** Substantial reductions in the number of fatalities and illness from infectious disease
- **Sustainable Urban Development:** Making cities inclusive, safe, resilient and sustainable
- **Water Resources Management:** Ensuring availability and sustainable management of water and sanitation

Illustration – global agricultural monitoring

G20 launched the GEO Global Agricultural Monitoring initiative to provide better information to reduce market volatility and in turn support global food security.

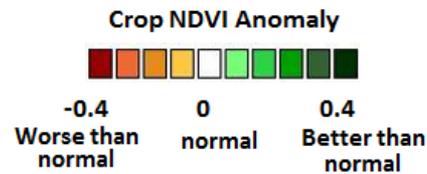
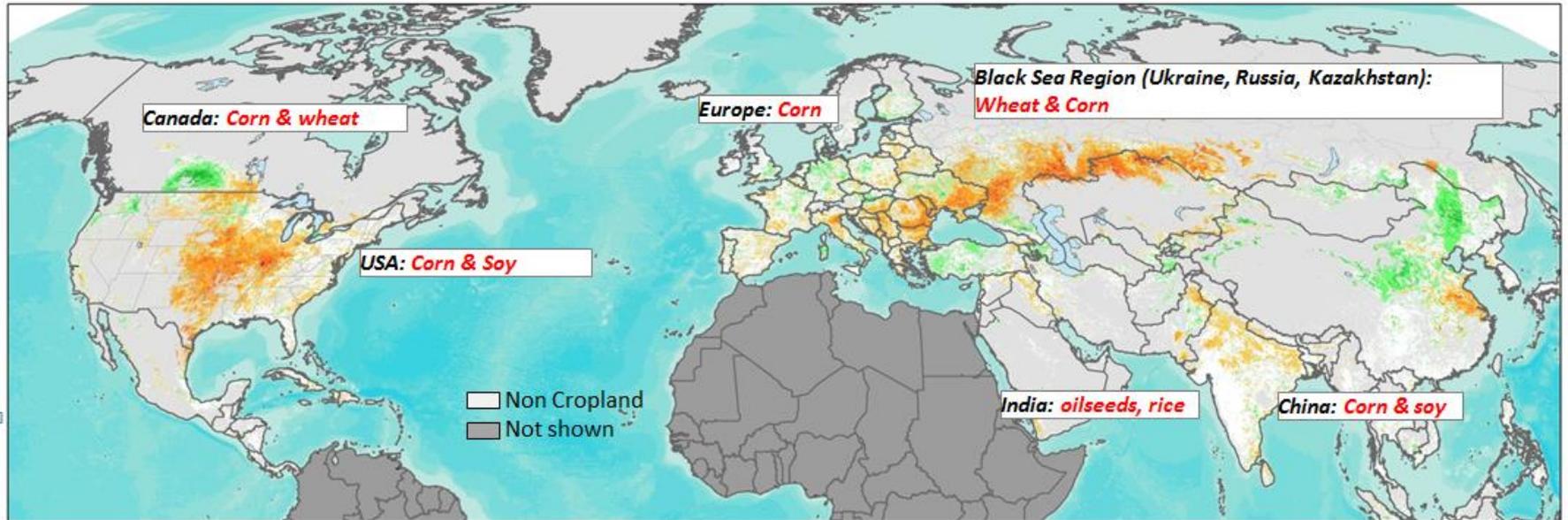
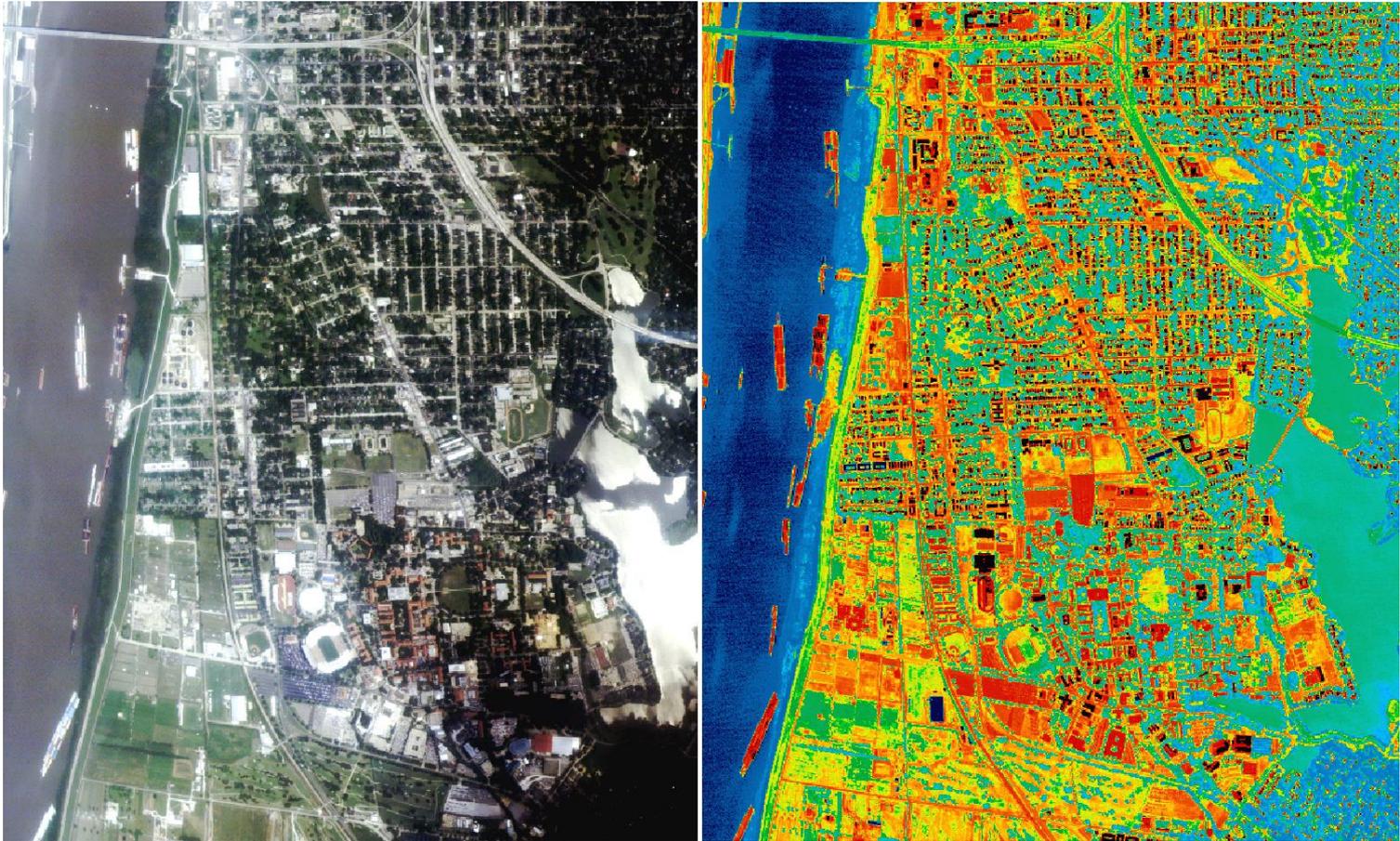


Illustration – climate change and heat island



Baton Rouge: The yellow and red areas are hot, and generally correspond with roads and buildings; blue and green areas are cool and indicate water and vegetation. The bright red areas in this image are about 65 deg. C (149 deg. F); dark green and blue areas are around 25 deg. C (77 deg. F). The solid blue swatch of color flowing down the left side is the Mississippi River.

http://weather.msfc.nasa.gov/urban/urban_remote_sensing.html

Illustration – humanitarian aid

Providing **up-to date**, **targeted** and **reliable** information on ...

(1) population numbers and densities



(2) potential groundwater reservoirs



(3) impact on the local environment



Andreas Papp, Program director, MSF, ESPI presentation, 2015

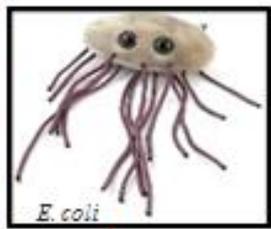
Illustration – environmental risk assessment



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Assessing and Monitoring Microbiological Quality of Surface Waters Using Tele-Epidemiology

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Evaluate the usefulness and the added value of remote sensing data as a component of the surveillance and management of microbial risk associate with recreational waters.



Illustration – fighting poverty

HEALTH POLICY AND PLANNING; 13(4): 408–416

© Oxford University Press 1998

Research reports

Ecological and geographic characteristics predict nutritional status of communities: rapid assessment for poor villages

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The quality of poverty alleviation programmes relies heavily on appropriate targeting and priority setting. Major problems in assessing poverty include identification of the indicators of poverty and the methods used for its assessment. Nutritional status, expressed by anthropometric indices, has been proposed as a poverty indicator because of its validity, objectivity, reliability and feasibility. **This study was conducted to explore the application of remote sensing to poverty mapping** based on nutritional status at the community level. Relationships between the nutritional status within a

Conclusion – looking up to space

Space exploration:

- The conduit of a deep and essential conversation on how we see the future of the human race and our planet

Fundamental human needs



Subsistence – protection – affection – **understanding** - participation
Leisure – creation – **identity - freedom**

- Enabling a wide array of spinoffs products and innovation for general or specialized applications on Earth and a powerful instrument of promotion of basic sciences for the advancement of humanity

Conclusion – providing societal services

Services from satellites:

- Touching nearly all societal domains, yet critical to specific areas
- Enabling the provision of an impressive array of services
- Unique potential for enhanced applications towards global development and global security challenges (for the global public good)

Fundamental human needs



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Conclusion – fostering a global capacity

Cooperation and policy perspectives:

- Balancing efforts towards responding to fundamental human needs vs. other wants
- Articulating priorities in support of developmental goals; providing humanitarian assistance and contributing to solutions to tangible global challenges
- Further enhancing cohesive approaches among United Nations organizations and other International capacities to enable effective leadership
- Consideration towards promoting principles of relevance, coherence, sustainability and global perspective