

Research, Education, and Outreach for the Urban Millennium: A Strategy for the National Capital Region Operations of Virginia Tech

Vision

The United Nations announced that 2009 was the first year in the history of humankind that more people lived in urban areas than in rural areas. Projections in population indicate that by the year 2025 almost 500 million people will live in metropolitan areas with 10 million or more inhabitants, with the fastest rate of growth of these ‘megacities’ in developing countries of the world such as Nigeria, Bangladesh, and Pakistan. Population in rural areas of the world is expected to begin decline in absolute terms around the year 2020, and it is expected that by 2050 over 2/3 of the world’s population will live in urban areas.

These fundamental changes in our global demographics raise myriad questions for nations regardless of their current stage of development. The global question is how societies will maintain some acceptable level of living as more of their population is concentrated in ever-larger urban centers. The answers to that fundamental question will be derived from how we face the technical and social challenges posed by questions such as:

- What forms of governance will prevail?
- What for new and useable infrastructures will be required?
- How we manage social and organizational relationships and the new sources of conflict that will abound?
- What type of economic systems can sustain this magnitude and distribution of growth?
- How can we ensure the safety, security, and health of this large new population surge?

The National Capital Region is well positioned to be the focal point for our Virginia Tech’s national and global leadership on the technical and social issues associated with this transformation. Well established outside of Washington, DC for nearly 40 years, the Virginia Tech National Capital Region (VT-NCR) has been committed to leveraging the expertise of our land-grant university in our nation’s capital. Recent investments in research facilities and a growing set of leaders in key areas such as resilient communities, security, energy, medical technologies, and policy informatics make VT-NCR strongly positioned for investments that will ensure leadership in the critical questions associated with the Urban Millennium.

The NCR office of Virginia Tech proposes to make research, education, and outreach for the urban millennium a key theme to our future planning. We believe that this theme builds upon the established strengths of all organizations at Virginia Tech, leverages our interdisciplinary strengths and recent investments in the National Capital Region, and provides a clear focal point for future planning decisions within the National Capital Region and across all units within the university. We also can be the location that redefines the land-grant mission of universities in a metropolitan context. Creating meaningful partnerships with industry and governments to solve critical and complex problems by co-locating researchers and practitioners in what can be termed “living labs” represents a new model for 21st century

outreach and engagement. The living lab approach is a user-centric, collaborative system of research and innovation initially evolved by the systems engineering community (see von Hippel, 1986, Chesbrough 2003*) where users, in partnership with researchers, drive problem formulation and research design and researchers are partners with users in implementation and evaluation.

We propose a long-range plan in research, education, and outreach that will build our national and international recognition in this field with the express purpose of pursuing partnerships that will grow the enterprise of the university, be consistent with our land-grant heritage, and be consistent with the strategic plans of the university. Rather than focusing on any of the social/technical systems deriving from the above questions, we argue that the appropriate approach is to focus on three key concepts associated with any of the issues or solutions embedded in the questions posed above. We argue that regardless of the systems, organizations, or scale of analysis (family, community, metropolitan, nation-state, etc) the appropriate focus is on:

- 1 The security and safety of the system or organization, that is, can it ensure that populations will not be at risk from either catastrophic or slow incremental changes (slow burn) resulting from the population transformation;
- 2 The resiliency of the system or organization, that is, is the system sufficiently robust to withstand major disruptions or threats to its stability and functionality whether those disruptions are a function of slow burn or sudden disasters; and
- 3 The sustainability of the system or organization, that is, can the system continue to function effectively over time without diminishing the resources it consumes or expanding the output waste to levels that are unsafe to populations.

Phase I of the NCR proposal builds upon our interdisciplinary strengths to enhance our leadership in the field **resiliency**, with a particular emphasis on mining the interface between science, technology, and policy within this field. Phase II of the plan will continue our emerging strength in **security and safety**, with a particular emphasis on our well established expertise in securing communication systems (wireless, networks, smart grids, etc) that will be essential to accommodating the expanded urban infrastructure needs. The final phase of the plan will connect these topics to the broader topic of **sustainability**, with emphasis on the interplay between these critical concepts on transportation and communication infrastructures, energy, and water resources.

* Von Hippel, E. (1986). Lead users: a source of novel product concepts. *Management Science* 32, 791-805.

Chesbrough, H.W. (2003). *Open Innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business School Press.