# CHAPTER 10

# A University Culture of Sustainability: Principle, Practice and Economic Driver

*Linda P.B. Katehi*

## INTRODUCTION

Sustainability — as we use the term in our classrooms, capitals and marketplaces — has evolved and taken on an almost mythical quality. The word is ripe with meaning, yet not well defined, and actions in the name of sustainability are similarly wide-ranging and varied.

As early as the 1800s, economic philosophers such as Thomas Malthus and John Stuart Mill recognized resource limits and the need for maintaining resources for future generations. Interest in sustainable resource use faded from view, however, as the Industrial Revolution brought higher standards of living to more developed regions.

The Green Revolution of the mid-20th century, with its enormous technological advances, promised to eliminate hunger and to sustain humanity at previously unimaginable levels (Wharton, 1968; Evenson & Gollin, 2003). By the 1960s and 70s, however, environmental costs associated with growing human populations and intensification of resource use were entering the public consciousness. Rachel Carson (*Silent Spring*, 1962), Paul Ehrlich (*The Population Bomb*, 1968) the Club of Rome (*Limits to Growth*, 1972), E.F. Schumacher (*Small is Beautiful*, 1973) and others gave voice to these rising concerns.

For much of society, the energy crises of 1973 and 1979 were crystallizing events, directly connecting the emerging principles of sustainability to our energy consumption; our dependence on access to limited resources to support economies, governments, lifestyles and future generations was suddenly appar-

ent. Responding to these challenges, the United Nations in the early 1980s established the Brundtland Commission to study global sustainability. The Commission's definition of sustainable development — that in which the needs of the present are met without compromising the ability of future generations to meet their own — is one of many in use today (Brundtland, 1987).

Academics, in their roles as innovators, scientists and philosophers, have been critical players in identifying these global problems and their potential solutions. University administrators were also quick to stake out leadership roles in global sustainability in a coordinated manner during the 1990s, as marked by the Talloires Declaration (University Leaders for a Sustainable Future, 1990), which recognized the unique abilities and responsibilities of universities to advance the study, teaching and application of environmentally sustainable practices.

In recent years, the notion of sustainability has expanded from a narrower focus on natural resources to include resilient and durable social, political and economic institutions, without which globally sustainable outcomes are unlikely. The Great Recession that began in 2007 and its long aftermath have further highlighted the need for sustainable financial models for institutions as diverse as governments, NGOs and research universities.

Today, there are dozens (if not hundreds) of definitions of sustainability circulating in academic and popular media, adding to the elusive and sometimes confusing nature of discussions on sustainability. Rather than selecting an existing definition or building a new one, I suggest in this paper a conceptual framework that can give structure to consideration of a range of sustainability topics. Then, I discuss unique aspects of academic culture that give research universities an unparalleled role in establishing the principles, modelling the practices and driving the new economics of sustainability.

## A CONCEPTUAL FRAMEWORK FOR SUSTAINABILITY

Instead of continually reworking definitions and interpretations of sustainability, it is time to shift our thinking. Sustainability cannot be simply a definition. It must reflect the processes at work at local and global scales that will determine what resources we leave to subsequent generations.

Many of the proposed "solutions" to global sustainability have a fundamental weakness: they assume that some entity will be able to enforce a single set of policies across the planet. Our attempts to apply global governance to problems of similar scale, such as those associated with the Kyoto Protocol on greenhouse gas emissions, have met with much frustration and limited success. Sustainability is likely to prove even more intractable with this type of approach, since the concept, at the outset more nebulous, will also be defined differently across cultures.

Therefore, a reasonable analysis of global sustainability must take into account the inherent differences between countries and cultures. Once basic survival needs are assured, the drive to obtain status, as defined by local culture, is of central importance to human actors. Societies prioritize very different sets of needs; within societies, individuals' expectations and preferences are molded by cultural forces independent of their own will (Marx, 1904). These constraints shape a society's preferred vision for the future, as well as its capacities for modifying its constituents' behaviours.

In addition to these cultural constraints, each locality has its own set of environmental constraints. Sustainability requires acting purposefully in the context of these constraints, then analysing how choices made in the local system will contribute to the potential for sustainability at the global scale.

For any given locality, sustainability requires maintaining — over the long term — supplies of resources essential to the well-being of individuals in that society. Nations dependent on irrigated agriculture may prioritize access to fresh water, while island nations may see the conservation of thin soils as most important. In addition to key natural resources like energy and food, other factors such as clean air and water, natural habitats, access to education, human health and aspects of cultural heritage may be prioritized in a given society.

All localities are, of course, embedded in the larger framework of the planet, and with it all the other localities and their collective activities. At the global level as well, there is a set of resources that must be maintained above a critical threshold to allow all the localities to maintain their human well-being. These global resources represent an absolute constraint on the sum of human activities.

Economic modelling suggests that, at the global scale, economic stability and even growth are possible given the constraint that some set of sustainability indicators must, at a minimum, stay stable over time (Martinet, 2011). It is a daunting task to model how the effects of different societal values and choices interact at the global scale to influence the shared pool of resources. These interactions, however, are the relevant ones for the real-world bargaining processes by which sustainability must be attained.
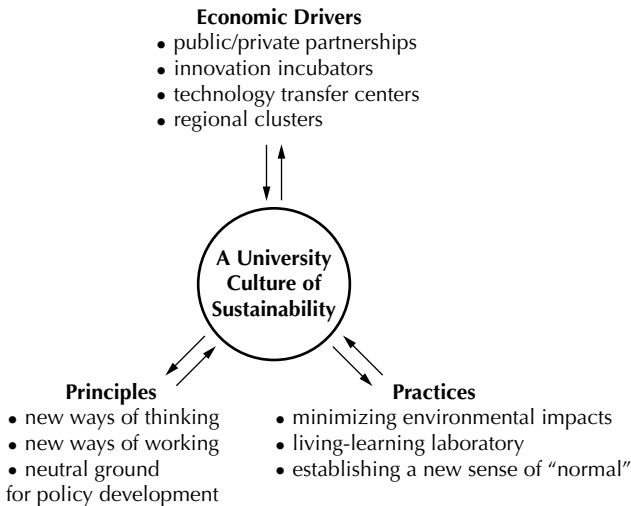
Inherent differences lend themselves to different sets of solutions, which rarely directly scale up to the global level. Because of these local differences in constraints and visions, societies are often not willing to adopt common global policies, but they may be far more likely to share common tools from which they can develop locally adapted policies.

Inevitably, we are locked in a world of divergent opinions and values. Local and global definitions of sustainability will always be in tension, as will local and global desire and capacity for effecting behavioural change. Scientific research will not resolve these conflicting viewpoints. Universities must therefore take the lead in expanding the toolkit available for advancing sustainability in the face of all these challenges.

## THE UNIVERSITY CULTURE OF SUSTAINABILITY

Higher education embraced the concept of sustainability early (Wright, 2002), though it took many years for passion and beliefs to translate into focus and action. The world's universities have a compelling responsibility to be at the forefront, breaking down barriers, taking risks and modelling sustainability. Universities are uniquely situated to take this leadership role, and, in fact, no other entity or system may have the ability, capacity and positioning to do so. A university culture of sustainability fuels the principles, practices and economies of sustainability, while being reinforced by them (Figure 1).

**Figure 1:** The relationship between a university culture of sustainability and the principles, practices and economic drivers of sustainability are self-reinforcing

**Economic Drivers**
- public/private partnerships
- innovation incubators
- technology transfer centers
- regional clusters

**A University Culture of Sustainability**

**Principles**
- new ways of thinking
- new ways of working
- neutral ground
for policy development

**Practices**
- minimizing environmental impacts
- living-learning laboratory
- establishing a new sense of "normal"

What factors make universities so well placed to respond to the challenges of sustainability? They are inherently multidisciplinary, enabling a diversity of research and opportunities for collaboration. Universities are grounded in their region, allowing them to adapt to a locality's unique needs, while simultaneously driving the region's economy. They are less tied to the short-term cycles (elections and quarterly reports) constraining our political and economic systems, freeing researchers to do the basic research necessary for innovation, while providing a neutral platform for open debate. The world's universities are the independent agents — the honest brokers — who create partnerships bringing science and policy together, then provide the necessary analysis, knowledge, tools, research and commitment to public service.

Public land-grant institutions, which have always enjoyed the support of their states in providing access to education, are now watching states quickly distance themselves from the land-grant commitment. At the same time, the public has found it difficult to reconcile its expectations of access to public education with its unwillingness to support that access, either indirectly through taxes, or directly through tuition. Universities have been widely criticized as irresponsible and unmanageable amid pressure to reduce size and cost, while simultaneously providing high quality. Efforts to reduce expenditures and size frequently conflict with state policies and with the public's expectation and appetite for a state-of-the art college experience.

It is against this backdrop, and perhaps because of it, that research universities must reorganize and change fundamentally. They are being driven to work more smartly and efficiently. They must become leaner enterprises while simultaneously innovating on the battle lines of the world's most challenging issues. Universities have long been seen as institutions whose mission is to tackle society's most pressing challenges.

Universities are busy creating these models of the future, testing strategies and forming partnerships. A culture of sustainability is being integrated into everything we do at the university, whether oriented towards the institution and its surrounding communities, or towards the larger society and our world. Instilling our actions with the core values of sustainability — a respect for people, the environment, and future generations — will allow those passing through our universities to integrate these concepts into their own principles, practices and economic decisions.

## Sustainability as Principle

Driven by a changing organizational culture, universities are embracing, developing and disseminating the principles of sustainability in their curricula, research programs and outreach efforts. The world's universities have the potential to bring everyone together on an even playing field: industry, environmental advocates, government and academia. A multidisciplinary approach allows universities to foster new ways of thinking and working, which is necessary in tackling the complex issues of sustainability.

Universities develop new ways of thinking, by investing in both basic and early-stage research. Increasingly driven by short-term interests, the private sector has tended to devalue research and development compared to earlier parts of the 20th century. For example, the deregulation of the energy markets drastically reduced private investment in R&D during the 1990s (Margolis & Kammen, 1999). Because of their educational mission and commitment to public service, universities encourage greater risk-taking. For example, at our newly opened August A. Busch III Brewery and Food Science Laboratory, two

rooms were built without any assigned uses, intentionally leaving them available for future innovations.

Universities also develop new ways of working. Many of our greatest challenges today, sometimes referred to as the "wicked problems", require collaborative and multidisciplinary approaches to develop solutions. With their diversity of academic departments, large universities have the infrastructure to create these multidisciplinary dialogues. They must, however, be willing to break down the academic silos and work across disciplines and with their surrounding communities. At UC Davis, the newly created Agricultural Sustainability Institute provides the institutional framework to allow faculty, staff and students from both social sciences and traditional sciences to collaborate on research projects investigating the impact of our food system on society. Accompanying its directors are a team of 24 full-time staff, 9 professorships in a range of disciplines, 150 other affiliated UC Davis faculty interested in sustainable agriculture and over 150 students; its association with the UC Cooperative Extension Program expands its reach to the business and public communities. Obviously, this effort represents a significant investment and a determination to make progress on an important societal issue.

Universities develop sound policies, by providing neutral ground for discussion and debate. For example, when the governor of California wanted to develop a Low Carbon Fuel Standard for transportation fuels, rather than turning to his agencies, he instead turned to UC Davis and UC Berkeley. A team of 20 researchers developed the policy by grounding it in science while simultaneously taking the politics out of the process. Industry, environmentalists and policymakers were involved from the start (Farrell & Sperling, 2007a). We know business cannot thrive unless our foundation is healthy and stable. We also know that cleaning the planet's air and water is not just good for our environment — it also creates jobs and improves the economy. So together, industry and academia created the first policy in the United States to steer the petroleum industry toward low carbon. It was eventually adopted in California almost as written — and it requires a 10% reduction by 2020 in greenhouse gases emitted by transportation fuels (Farrell & Sperling, 2007b). The northeast states in the U.S. are now considering a similar standard and there is also interest in it on the national level. UC Davis has also been consulting in Canada, Europe and China on models for low-carbon economies.

## Sustainability as Practice

Universities have a responsibility to be leaders in implementation of sustainable practices. At the most basic level, sustainable practices, such as green buildings and energy efficiency projects, save money and minimize impact on the environment. However, as places of higher education, universities can

turn their campuses into living laboratories, which serve as a testing ground for new research, while engaging students in experiential education.

Higher education is competing with the background "education" that comes from one's surroundings — such as that from superhighways, shopping malls, urban sprawl, entrenched industries, television and non-stop advertising — in establishing a sense of what is "normal" to our youth (Orr, 2002). The innovative research and operations policies that are outgrowths of universities' cultures of sustainability can directly engage students in sustainable practices, and challenge what students perceive as "normal". This engagement will pay dividends for society as these students, our future leaders, carry these innovative practices into their workplaces and personal lives. Universities act as drivers of social change by challenging our very ideas of "standard practices".

As an example of the tight integration of sustainable practice with student learning, UC Davis is building what will become the largest zero-net energy community in the United States, West Village (Finkelor *et al.*, 2010). The first phase will open in fall 2011, housing students who will bike and ride the bus to classes. The buildings incorporate cutting-edge energy and environmental design, and the community will generate renewable electric power. At face value, this project is simply an effort to reduce energy costs, while minimizing environmental impacts. Yet, it is much more than that. The project is a public-private partnership involving many of UC Davis' research centers, including The Energy Efficiency Center, The Energy Institute, The Center for Water-Energy Efficiency, The Western Cooling Efficiency Center, The California Lighting Technology Center and The Biogas Energy Project. West Village provides a platform for university researchers to work across disciplines and apply their research to real-world scenarios. The project will eventually include homes for our faculty, retail space and a dynamic village center. The project — because it is sustainable, coherent and comprehensive — will serve as an international model.

A more targeted example of the living laboratory at UC Davis is the California Lighting Technology Center — a university-sponsored collaboration with industry — charged with developing more sustainable lighting. Our campus is implementing a US$39-million initiative to apply efficient new technologies, not only to save money, but also to use the campus as a large-scale testing ground. The new lighting technology deployed in parking garages, for example, serves as a prototype to assess the quality of the technology and to see if better lighting reduces crime around the garages. Lessons learned from these experiences will improve the products, thus speeding the adoption of more sustainable infrastructure in the rest of the community and nation.

Practices should not be limited to large, multimillion-dollar initiatives. Smaller-scale initiatives often provide the greatest opportunities to engage

students, providing valuable experiential education in core sustainability fields. For example, students at UC Davis can train and work in organic agriculture at our Student Farm, or conduct research at the Russell Ranch Long Term Research on Agricultural Systems (LTRAS). The students' work is not simply a classroom exercise: the produce from the Student Farm is sold through a CSA (community supported agriculture) to Davis community members, while the tomatoes from Russell Ranch are used by Sodexho in its campus dining operations. Connecting educational opportunities with operational practices is an essential part of building a sustainable framework.

By taking a leadership role in sustainable practices, universities minimize their environmental impact, provide a testing ground for applied research, engage students in experiential learning, and establish a new set of expectations for "how things should be" that students can take with them to future employment. Fine-tuning practices in the university setting allows researchers to make the necessary modifications to scale up these practices to best serve society. When combined with innovation hubs catalyzing technology transfers to the private sector, sustainable practices can catalyse regional economies.

## Sustainability as Economic Driver

The coordinated push for sustainability has invigorated the generation of knowledge in science, technology and policy. This new knowledge is driving innovation and the creation of new products and services. The biggest challenge and opportunity for any organization — and for public universities particularly — is to channel our new culture of sustainability into ideas and behaviours representing a paradigm shift.

Universities have demonstrated their capacity to act as regional economic drivers, as evidenced by dynamic economic zones like Silicon Valley and Rochester, NY. Communities leverage research and people emanating from the university, along with private partnerships, to develop clusters of economic and technological innovation. Universities can create centers to bring disciplines together to move ideas out of the lab, establish incubators to develop projects separately from the university setting, and finally are capable of creating centers to transfer these technologies into the workplace. Today, sustainability is driving innovation and creation of new economies (Nidumolu *et al.*, 1998); universities and their communities have a head start on being able to productively respond to these new opportunities.

Often, advances on campuses can be directly applied beyond the university. For example, student teams at UC Davis have developed a solar-powered light that is less expensive than candles or kerosene — it also emits far less carbon. Already tested in Zambia and Nigeria, the light could make a significant dif-

ference in quality of life and in carbon emissions for the 1.5 billion people still using petroleum-based fuel to light their homes (Creed *et al.*, 2010). As another example, Professor Pamela Ronald recently developed a flood-resistant rice strain through precision breeding with three to five-fold increased yields under flood conditions in Bangladesh, India and Indonesia. Universities provide a unique platform for these types of intellectual advances, which translate to increased productivity with a reduction in our use of resources. UC Davis is committed to enabling this kind of technology, while simultaneously training a new generation of educators and leaders to understand the complexities and interdisciplinary nature of sustainability.

Aiming to invigorate partnerships that spur creativity, UC Davis has designed an innovation incubator — the Engineering Translational Technology Center. This is an on-campus facility where faculty can develop their projects while ensuring separation of intellectual property and technology transfer between the campus and start-up companies. While universities are well known for their knowledge generation services, they are historically not as good at transferring these technologies to the private sector. Complex intellectual property policies typically hinder researchers from commercializing technologies developed on campuses. Privately funded, our Engineering Translational Technology Center provides a platform for researchers to turn their ideas into private businesses in a familiar and secure setting. Incubators are already demonstrating their potential to transfer ideas into the workplace: UC Berkeley's Business Incubator has helped secure $1.7 million in funding for zipReality.com.

Along similar lines, UC Davis has established the first university-based Energy Efficiency Center focused on transferring relevant technology into the marketplace. We have also invested in a Center for Entrepreneurship to bring science, engineering and business together to move ideas out of the lab and into the world. Thanks in part to these efforts, UC Davis has formed 34 start-up companies since 2004 — 9 of which formed last year alone. We would like to improve this number and create close to 15 annually. UC Davis is now in the process of creating an Innovation Hub to connect research with entrepreneurs, accelerate the transfer of campus discoveries into commercial products, and develop the local and regional economy.

In the 1950s, Stanford's Frederick Terman had a specific vision — to foster a cluster of high technology firms around the Stanford campus in order to keep the talented Stanford graduates in the region. That cluster became known as Silicon Valley, responsible for many of the innovations behind the computer revolution, and creating one of the strongest regional economies in the nation. This plan succeeded for three reasons — it linked students and faculty with surrounding firms for jobs, created an Industrial Park on the Stanford campus to incentive firms to relocate, and it used incubators to catalyze tech-

nology transfers from the classroom to the workplace (Huffman & Quigley, 2002). This is what we are doing at UC Davis, demonstrating the power of universities to drive economic change.

All of these initiatives feed into our plan for UC Davis: providing higher productivity by enhancing output while reducing our use of resources, a reflection of the extent to which an ethic of sustainability has permeated our university culture. Our plan will generate growth by creating new ideas, new relationships and new structures, by reducing bureaucracy and embracing risk taking, and by encouraging and supporting free thinking about the opportunities and responsible planning against the challenges. This is the new university: an intensive and intentional organization that can find meaning and order in unconstrained thinking, providing focus and a disciplined approach.

## CONCLUSIONS

A century ago, visionary leaders established a regionally based network of agricultural experiment stations at land-grant universities and colleges to connect university research with farmers to solve real-world problems (Hatch Act 1887, Smith-Lever Act 1914). This network enabled universities to create tools to overcome local constraints, while simultaneously sharing their tools with other stations to help farmers to provide enough food for the nation.

Today, we are faced with a similar predicament in which localities, facing different environmental and social constraints, are both contributing to and being impacted by the global issue of sustainability. Universities have demonstrated their ability to drive economies and social change. An organizational culture of sustainability must be at the heart of the university's principles, practices and economic partnerships in order to ensure that the innovations and dynamism emanating from campuses advance the dual goals of local and global sustainability.

Universities must act, and as they do so, they must break from the past. The traditional university as isolated actor will not conquer the future, and may not even survive into the future. Behaviours and structures must fully embrace collaboration and multi-disciplinary solutions. Tools must be created and shared. These frameworks are beginning to be built: R20, an innovative international effort bringing together local governments, NGOs, corporations and educational institutions, enables collaborations leading to concrete action to combat climate change and build the green economy.

The world's universities must be bold and creative, yet disciplined and frugal. It is possible. If universities work together, as partners and collaborators, they will be the models, the living laboratories and the solution.

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