

University of Arizona  
College of Agriculture and Life Sciences

Strategic Plan Background Document

For use with the CY 2005-2009 Strategic Planning Process

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**Preface**

This Background Document is for use with the College of Agriculture and Life Sciences Draft Strategic Plan for Calendar Year 2005-2009. It contains information used to develop the strategic plan, including national and local studies, needs and directions of Arizona, driving forces of change, and assumptions. It also includes implications of some of these changes and how the college might react to them.

The Strategic Plan Draft includes details on the strategic issues CALS will address, the areas we will emphasize, and our six program areas that are used to implement these issues and focal areas. In addition, it defines our goals and challenges, gives guidance on implementing the plan, and defines assessment criteria and performance indicators. These choices were made by using the included materials about our external environment, working with committees and administrators, reviewing input from clients and receiving suggestions and comments from our faculty and staff.

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## Executive Summary

The future cannot be predicted; but, it can be anticipated. By understanding the driving forces of change and allowing for uncertainties and wildcard events, you can identify and focus on the few important themes that emerge. This gives a much better understanding about the range of possibilities when developing strategic plans. It also identifies areas where more information is needed and builds a culture that allows a flexible, agile, sustainable approach to doing business.

This report is structured as an overview of the driving forces, uncertainties, and wildcards. It also identifies events or trends that are so likely we can call them near certainties. The report includes examples of studies about the future done by others. The report provides specific examples, but is not a large collection of individual trends; this approach can focus too much on the small detail and miss the overall patterns that are important to understand. Finally, the report identifies activities underway by the Arizona Board of Regents and the University of Arizona that help further guide our planning process.

There are a number of near certainties – events or trends that seem so likely that we could legitimately view them as certainties. Those identified in the report are:

1. Increased Diversity and Cultural Transformation.
2. Aging and Migrating Populations.
3. Infrastructure Constraints Become More Evident.
4. Government Services vs Taxes: Financial Impact in 2010-2015 Period.
5. World Order and Polarization.
6. Personalized Connectivity.
7. Institutions as We Know Them Will Change.
8. Sustainability.
9. Technology: A Major Driving Force of Change.

There are also many uncertainties. The uncertainty is not in whether the topic is important but that we don't know how the trends and events will turn out. Examples include:

1. Technology and Work.
2. World Order.
3. Environment and Economy.
4. Government Services vs Taxes.
5. Rich and Poor Gap.
6. Global Climatic Change, Energy, and Water Resources.

And of course there are possible events that might happen that we cannot articulate in advance. These are the events that may be a low probability but will have a large impact, and therefore are worth thinking about in advance. While it is difficult to determine any specific wildcard event in advance, the preparation for the unknown and how one responds to such uncertainty can be helpful when transferable to whatever wildcard does take place. Examples are:

1. Dramatic energy costs increase or water supplies decrease to shift more costs to providing basic needs.
2. Decrease in litigation with increase in mediation restructures the legal world.
3. Trade wars and embargos cripple the global society.
4. Terrorism slowly, simply, and methodically attacks developed societies, effectively eliminating them.
5. US average life expectancy increases from 74 for males and 79 for females (2004) to 100 by 2050.
6. A series of natural disasters hits major population centers in rapid succession (earthquakes, hurricanes).
7. A major stock market collapses, bringing down all interrelated stock exchanges worldwide.
8. Regional urban centers are developed under the ocean.

The bottom line is that we are entering a period of more rapid change, involving technology, culture, and interactions with others groups and people. For those who have anticipated the future through reports of this type, they have a greater probability of successfully and productively navigating these changes. This report is a “snapshot” of a collection of trends and events related to the future. Another look, from another perspective at another time, may produce different results. Therefore it is important to learn some of the tools of the trade, so the reader understands how to anticipate the future on their own, on a continuing basis. Selected information sources and further reading on topics of current interest are provided for this purpose.

## Introduction

The last major revision of the College of Agriculture and Life Sciences (CALs) Strategic Plan was in 1990, that process involved a series of forums, planning materials, and an administrative retreat. Subsequent revisions were made in 1995 and 2000 but they resulted in relatively minor changes. This revision is expected to be substantial.

The University of Arizona Strategic Plan submitted a draft Strategic Plan to the Arizona Board of Regents (ABOR) in August 2004. The UA Strategic Plan is for five year increments, updated annually. The plan is to follow guidelines/format set by the Arizona Board of Regents (ABOR) and the State of Arizona Office of Strategic Planning and Budgeting (OSPB). The current plan draft will be reviewed by ABOR and OSPB in fall 2004, and be published formally in January 2005. The version of the plan represents a major change in content, format and approach this year and we have tried to link the essential elements of the CALs plan to the UA plan (mission, vision, values, and goals).

There are some other activities underway in the State of Arizona, the Arizona Board of Regents, the university and college that relate to this planning activity. Statewide studies in the last several years have focused on economic development and the strengths of the universities, and new and recurring issues in the state have been addressed by the Arizona Town Hall since 1962. The ABOR has allowed the universities to differentiate themselves from one another through its Changing Directions, and the UA has identified four areas for Focused Excellence

This background document identifies relevant reports and their conclusions and addresses implications that some of the anticipated changes could have on our college.

This planning revision for the college is an important event. The changes in the external environment and within the university are potentially far reaching and will have a large impact on the university and CALs over the next five year planning period. It is important we have a well thought out strategic plan to provide a roadmap for how we take advantage of the opportunities and mitigate effects of the more unpleasant changes.

## Snapshot of CALS

The College of Agriculture and Life Sciences has approximately 1900 undergraduate majors (the College of Science has about 2400), and 400 graduate students (the College of Science has about 760). The college has about \$41 million dollars in grants and contracts (the College of Science has about \$109 million, but includes major entries for the Lunar and Planetary Laboratory and Steward Observatory). These contracts/grants are distributed into 60% for Agricultural Production Systems, 31% Agriculture and Environment, 6% Economics and Quality of Life, and 3% Food and Health (Government Performance Results Act categories).

Our student grade point averages and SAT/ACT scores are similar to the College of Science and above the UA averages. In spring 2004 we have about 600 classified staff, 170 academic professionals, and 250 faculty with tenure or with continuing appointment. Including in these figures are 63 cooperative extension faculty in the counties.

The college effort is distributed among six program areas (see table) and the audience for college programs, on- and off-campus has the greatest breadth of any college at the UA. The college has increased its research contracts and grants and maintained its student enrollment, while losing faculty and staff through budget reductions or non-growth budgets over the last decade or so.

Table 1. Percent Distribution of CALS Effort by 6 Program Areas and Type of Funding

Funding Type	ENR	FYC	HNF	MTE	AS	PS
Extension	19	41	10	3	6	21
Research	37	3	8	4	14	34
Instruction	26	12	12	12	19	19
Total CALS	32	12	9	4	13	29

Note: ENR=Environment and Natural Resources; FYC=Family, Youth, and Community; HNF=Human Nutrition, Food Safety and Health; MTE=Marketing, Trade and Economics; AS=Animal Systems, and PS=Plant Systems. Based on year 2004 numbers for all personnel on all funds from each department and estimates by unit head on distribution of efforts among extension, research and instruction for each program area.

The College of Agriculture and Life Sciences has:

- A combination of teaching, research and extension (with offices in each county) unique in the university structure. The college is the largest university unit in term of international programs and has a substantial number of cooperative ventures with agribusiness, farmers, ranchers and other organizations within the state.
- A history of interdisciplinary approaches to both practical and theoretical problems growing from a college with more disciplines housed under a single administrative unit than any other academic units on campus.
- A recognized superior attitude toward instruction and counseling or advising of students and is moderately well supported by scholarships for undergraduates. In addition, it has a strong supportive alumni group and a substantial extramural funding base.
- Individual faculty and programs that are a major strength. There are a number of specific program areas where substantial expertise and recognition resides. A number of the programs and faculty are known and recognized both nationally and internationally.

## **Assumptions**

*We will maintain traditional programs but the programmatic focus will change.*

Production agriculture (plants and animals) will continue to be a viable component (though a declining percentage) of the state's economy and will need servicing by extension and research faculty. Undergraduate programs in agriculture will still be needed and the Tucson campus will remain the location of Arizona's major agricultural instruction and research effort. However, there will be an increasingly greater emphasis on other areas that largely relate to agriculture but in new ways.

*The student mix (full-time, part-time, lifelong learning) and how students learn will change during the next 10 years.*

Increases are expected in traditional age, non-traditional age, and part-time students. Increases should be seen in graduate students, community college transfer students, minority students, and those needing additional skills assistance. An increasing fraction of students in the college will be urban-oriented and the college will continue to be involved internationally and attract foreign students.

*Changing times will require institutional flexibility and deliberate administrative efforts.*

"Changing times" will require new adaptive and flexible teaching, research, and extension approaches that are able to accommodate advancing technology and opportunities for interdisciplinary cooperation. New technologies and student learning styles will cause changes in the way we design and deliver courses

*Arizona's rate of economic growth during the next 10 years is expected to be better than that of the rest of the country. The degree to which the university will benefit from this growth is uncertain.*

Perturbations and uncertainties in economic and international conditions may have significant effects on internal planning and operations, and may occur with little warning unless contingency planning is practiced. Modest growth rates in the economy will also continue to face competition for state funds by other agencies or organizations.

*Internal reallocation of resources will be important funding methods, in addition to new funding by state appropriation or sponsored projects.*

To effectively pursue selected areas of opportunity and strength will require appropriate resource expenditures. However, not all programs can be treated equally and external funds may be insufficient to focus selected areas. Accordingly, internal reallocations (based on appropriate evaluative methods) will be required. The college will become more focused on subject areas.

*Collaboration and partnerships will increase but so will competition.*

Cooperative Extension faces competition with commercial information sources and products of other universities. Research will become more competitive as formula funds change in favor of competitive grants and increased numbers of research oriented universities compete for these funds. Instruction competition comes partly from on-campus majors but also from opportunities for distributed learning opportunities (even though these courses may be a small portion of the student's overall course load). Collaboration and partnerships will minimize the impacts of competition and also be necessary for managing needs with available resources.

*Market-based changes will increase as public support remains low.*

Market activities are expected to play a (much) larger role in student recruitment and retention, faculty salary sources (public as well as private funds for faculty and research support personnel), and grants and contracts (to a greater payment for services).

# Understanding our Changing External Environment

## ***Eight Driving Force Categories and Representative Trends***

Driving forces can be thought of as “clusters” of related trends. Trying to address each trend independently is too difficult (there are too many), but by grouping them into a small number of general categories, the collective effect of the related trends is much easier to comprehend. These representative trends are grouped under eight driving force categories.

### *1. Economy and Financial*

- Sustainable practices become institutionalized on how institutions operate and products are produced. Institutions take a more comprehensive view of clients/customers by providing on-going services rather than piecemeal responses to needs.
- International trade/trade deficits, public and private debt, and economic inequalities (in world and in US) continue.
- Trend extrapolations become complicated by better understanding of how chaotic behavior affects the economy and its analysis.
- The role of return on investment or the measures of progress may be changed from those used today.

### *2. Political and Governance*

- Continued debates in matching tax rates with desired public services and impacts on country of inaction or extreme action.
- World order becomes clear as countries work together to guide/monitor how countries function in the world economy.
- Political parties are impacted by rise in individual power (through networking and information sharing) with possible changes to the two party system.
- Rise of China’s and India’s (two largest countries) workforces as a world resource and related changes in political influence.

### *3. Population and Demographics*

- Number of post 65 people and post 85 people continues to increase as a percentage of population.
- Immigration conflicts, worldwide, occur as the increasing percentage of immigrants in the population changes the culture and economy of the developed nations (for the US this is predominantly Hispanic populations).
- With few exceptions, people will continue to retire near where their relatives are located. Arizona and California are not exceptions to this rule.
- Aged like to live near home don’t move unless special circumstances; migration continues from least desirable states, dependency ratio increases for all states (fewer working to support more young and old).

### *4. Resources and Environment*

- Global climatic change is acknowledged and mitigation measures become vigorously pursued.
- Energy supplies are extended due to increased energy efficiency and alternative sources.
- Water (quality and quantity) continues to be a problem but begins to be addressed by lower cost desalination methods.
- Green manufacturing/building processes and materials, and operation of buildings, will increase, giving rise to more sustainable and automated business and industries.

### *5. Science and Technology*

- Many new technologies make major changes in health, manufacturing, knowledge management, learning/training and infrastructure (including buildings, highways, cities, management). These allow new communication and seeking the relevant information for decisions rather than collecting all available data.
- Key technology areas are in biology (including genetic engineering), materials (including nanotechnology), and information/communications.
- Embedded technologies allow unobtrusive devices to monitor and to react to needed actions, reducing the need for human intervention for ‘routine’ activities. Everything can get smarter and do the drudgery work or monitor in the background to alert someone, or another device, when something needs attention.

- Robotics and micro-robotics, already address highly repetitive work or work in unsafe environments. These robotics will continue to become smaller and smarter and take on even more tasks.

#### 6. *Social and Cultural*

- Conflicts increase among people and countries with different values as the global economy grows and as communication increases, and as changes in technologies raise issues than cannot be fully addressed by traditional approaches.
- Respected organizations will be seen as providing extra value through their behavior and relationships with customers/clients – through their emphasis on best practices, efficiency, quality and ethics/societal responsibility, as well as realistic price and speed for production and operation.
- Diversity will be more common and cultural norms of the past will give way to “multiple” norms to better reflect a diverse society.
- The current polarization in the media (traditional and individual publishers on internet) and polarization in many of elected officials will yield to a more moderate and practical approach to problem solving.

#### 7. *Work and Leisure*

- Employer based benefits move to employee focused benefits and thus become transferable between jobs. Increased demands will be seen for day care, health prevention, or other services as related to employment.
- Many job classifications will remain the same but the functions will change, with incorporation of automation and remotely accessed positions; employee location will become more independent of the job location. Other job classifications will develop to address how employees might be more entrepreneurial or use specialized contract arrangements.
- The workforce will be reshaped by reduced need for some workers where technology does the job or where jobs are outsourced to other countries. Workers will be working but not necessarily at a group location.
- Leisure time will be varied and increasingly include life long learning, working longer, or volunteering. Blending of home/office/family issues will occur.

#### 8. *Higher Education*

- Debates are raging over the role of private enterprise linkages to the university, faculty tenure policies, student learning models, and innovative funding arrangements.
- Forecast enrollment growth over the next 15 years is uneven in the country, but Arizona is among the few states that is expected to continue a strong growth pattern.
- Technology has been adopted in various degrees in different institutions, with all using it to some degree. Substantial additional uses of technology will occur in the learning area as well as administrative use.
- Competition continues to be strong between the various types of student audiences, with some universities forming partnerships with other universities or corporations to share resources.

### ***Other's Observations about the Future***

These organizations and individuals represent different approaches to understanding the future. Web addresses are given for further details. There are additional futures studies listed under Arizona and university studies.

#### **Institute for the Future**

These six trends are from their “Map of the Decade”; they occur with individuals, organizations, communities, markets, or households and daily life. Original material can be found at [http://ifff.org/docs/SR-797\\_Map\\_of\\_decade.pdf](http://ifff.org/docs/SR-797_Map_of_decade.pdf) (2003)

- **Emergence** – top down control gives way to bottom up sophistication. This increases unpredictable phenomena that occur when lots of individual actors following simple rules create complex behavior. This increases connectivity among people and how they interact with one another, direct link marketing and supply activities, and innovation is distributed.
- **The New Agency** – trusted agents to self as agent. Who acts on behalf of the individual, the organization or the community, and who assumes the risks and burdens? Consumers take on more risks in own decisions and are more engaged in these processes (so they are not just “customers”), the user defines what they want (individually customized), and energy production is distributed.

- **Shared Value** – value of proprietary ownership to value of shared interests.  
Shared value is the increased value that information products and services acquire when they are held in common by players with diverse interests. Tasks are shared across different households, people develop their own media rather than using mass media, networking replaces hierarchies, organizations become “hybrid” models, and technology personalizes devices for the individual.
- **Focus and Fusion** – from virtual boundaries to embedded focal points.  
In a distributed information world, the search for center, fuses with real places, comes to the foreground. Entertainment is developed by individuals and households, physical places fuse with virtual places. Consumers want simple messages not complex choices, and certain countries specialize in specific topics. Cross organization communication grows, and this changes how things are marketed.
- **Smart Presence** – from episodic interactions to persistent experiences.  
Presence is defined by where you have been, such as digital tracks left behind by visitors to public places. There are more ways to do everything – stay connected, express yourself, monitor friends, processes, or places. The embedded society is immediate, always connected. Real time productivity monitoring of worker health, building health, product lifecycles. All this is from very small scale technologies that can be embedded in everything.
- **Health Values** – from traditional health care to a burgeoning health economy.  
Health values are like family values – they provide a touchstone for all kinds of decisions in the home, in the workplace, and in the community. There will be more in-home health care using home health technologies, health is by a community of people focused on the individual, new health networks emerge through employers, schools, insurers and retailers. A focus will be on healthy places and healthy spaces, and traditional health care will be a part of this but augmented. More responsibilities will fall to companies rather than government. Finally technology mimics biology as to possibilities (e.g., tissue scaffolding for replacement skin, neural net programming, bones as models for helmet materials).

### ***Global Business Network***

From the book “Inevitable Surprises: Thinking Ahead in a Time of Turbulence”, by Peter Schwartz.  
<http://gbn.org/ArticleDisplayServlet.srv?aid=14200> (2003)

"Most organizations and most people assume that the world in front of us is basically continuous—that tomorrow is basically going to be pretty much like today," he said. In fact, the opposite is true: We live in a time of perpetual discontinuity, a time in which bombshells and shockers are part of everyday life. "The surprise," explained Peter, "would be no surprise." These examples were selected from the book by GBN (see site above).

- **Nearing the end of retirement** – Americans are not retiring and are working at some type of job.
- **Continuing high-growth economy is inevitable** – caused by productivity driven by new technology and globalization.
- **We’re moving toward a new world order** – the world is organized into three groups: disorderly countries (chaos is rampant), orderly (traditional industrialized regions), and the United States (which makes the rules but does not play by the rules).
- **We are in the first stages of another scientific revolution** – revisited view of how the universe works; reinvent our understanding of the large scale, the small scale, the chemical, the biological.
- **Polluting technologies get clean** – with the pace of technological change, high growth equals clean, low growth equals dirty.
- **Abrupt climate change is coming** – the long period of climatic stability may be ending.

## European Commission, Forward Studies Unit

“Five Possible Scenarios for Europe 2010” – [http://europa.eu.int/comm/cdp/scenario/scenarios\\_en.pdf](http://europa.eu.int/comm/cdp/scenario/scenarios_en.pdf)

The preparation of the five scenarios included looking at 13 driving force areas. The examples below represent the commonly used trends and the range of possibilities in developing the scenarios. The full 121 page report is available at the above address.

- Low population growth, with viewpoints on immigration as open or closed.
- Technologies ranging from no major breakthroughs to major breakthroughs.
- Increasing individualism and fear of the future or renaissance of social/ecological awareness or revolt of the bottom half against globalization.
- Globalization continuing with sectoral resistances and local difficulties, to globalization accelerating with a “borderless world” to trade and regional conflicts, to global crisis.
- Broad macroeconomic policies with limited coordination and limited tensions to different levels of coordination or tension, including complete failure of economic policies.
- Acceleration of deregulation and privatization of industry to new policies with focus on users, to “mercantilistic” industrial policies.
- Continuing adjustment of social protection to employees, to strong market deregulation to strong resistance against welfare state reform to radical reform of the welfare state with individual incentives.
- Institutions have mixed strength with increasing regionalism to weak institutions to strong institutions.
- Governments constrained by interdependence and lack of consensus, to downsizing government or institutional renewal, to paralysis.
- Trade unions continue decline with persistence in protected sectors, to terminal decline, to decline reversal.
- The economic role of non governmental organizations ranges from not significant, to significant, to very significant (taking over the welfare state).
- Transnational corporations (TNC) increasingly important, to declining corporate advantage, to political reaction against TNCs.

### **Selected Excerpts of Studies Indicative of Emerging Trends**

These excerpts are taken from recent sources that indicate some of the changes underway. Formal trends take time to identify and thus indicators of emerging trends are useful. While you have to be careful to avoid temporary fads, the points below are sufficiently likely that they are used as examples of anticipating the future.

- **The Future of Work** – The future will be less about what technology can do and more about what we want to do with technology. Will that technology be used primarily to boost economic efficiency, or will it also be made to serve a broader set of human interests and values? Organizations that do the later will attract the most desirable knowledge workers and be more effective and efficient in the long run. – *Thomas Malone, Author of The Future of Work: How the New Order of Business Will Shape Your Organization, Your Management Style, and Your Life. Source: Global Business Network (2003).*
- **Redefining the Enemy** – Increasingly we are at war not with enemy states or enemy armies but with small groups of people or with specific individuals: fugitive terrorists, drug traffickers, warlords, dangerous dictators, rogue scientists. Yet powerful institutional barriers to fundamental change remain. In the armed forces, there is still a tendency to view the current situation as an anomaly – as the “other war” as opposed to the “real war,” as missions to be consigned to specialized units rather than to main forces, as opportunities to gain valuable field experience but not a compelling argument to radically alter how we organize to fight. We adapt incrementally. Given our great strength, that may suffice. But one wonders. It is nowhere written that we will win. *Source Rand Corporation, Rand Review (2004).*
- **Green Building** – The Bank of America and the Durst Organization (Real Estate Firm) break ground on the BA Tower in New York City build the world’s most environmentally responsible high rise office building (2.1 million square foot, 52 story, and \$1 billion cos.. With an emphasis on sustainability, water efficiency, indoor environmental quality and energy and atmosphere, the BA Tower will be constructed largely of recycled and recyclable building materials, feature a wide range of sophisticated environmental technologies, an onsite 4.6 megawatt cogeneration plant, and has a LEED Platinum designation. *Source: Durst Organization News (2004).*

- **Smart Mobs: The Next Social Revolution.** – The ingredients are RF Chips, wireless internet nodes throughout buildings and neighborhoods, using individual’s personal computers for collectively searching for extraterrestrial intelligence, buying and selling on the internet, instant text messaging and friends’ mailing lists used for convening meetings of people outside your own circle. The action is people who are to act in concert even if they don’t know each other. The individuals operate in ways that were never possible, because they carry devices that possess both communication and computing capabilities. These participants will coordinate actions with others around the world, and with people nearby. Groups of people using these tools will gain new forms of social power, new ways to organize their interactions and exchanges just in time and just in place. (text paraphrased). *Source. Book on Smart Mobs by Howard Rheingold (2003).*
- **Complexity and the Economy** – When viewed in out-of-equilibrium formation, economic patterns sometimes simplify into the simple, homogeneous equilibria of standard economics. More often they are ever-changing, showing perpetually novel behavior and emergent phenomena. Complexity therefore portrays the economy not as deterministic, predictable and mechanistic; but as process-dependent, organic and always evolving. *Source. W. Brian Arthur, Santa Fe Institute.*
- **Energy Transitions** – In 2001 Shell Oil developed two scenarios to contrast an evolutionary progression from coal to gas to renewable (or nuclear) against the potential for a hydrogen economy. The scenarios have five common features: 1) the important role of natural gas as a bridge fuel over at least the next two decades and the importance of reducing supply security fears, 2) the strong pressures and volatility which oil markets will face as new vehicle technologies diffuse, 3) the shift towards distributed or decentralized heat and power supply for economic and social reasons, 4) the potential for renewables to be the eventual primary source of energy and the importance of robust energy storage solutions, and 5) the difficulty of identifying winning services or technologies in a period of high innovation and experimentation. *Source: Shell (2001).*

## Studies about the Future that Focus on Arizona and Its Universities

### Priorities of USDA and Research Agencies

The USDA Cooperative State Research, Education and Extension Service (CSREES) defines the national emphasis areas as:

- Agricultural & Food Biosecurity
- Agricultural Systems
- Animals & Animal Products
- Biotechnology & Genomics
- Economics & Commerce
- Families, Youth, & Communities
- Food, Nutrition, & Health
- Natural Resources & Environment
- Pest Management
- Plants & Plant Products
- Technology & Engineering

### National Research Council: Information Technology and Universities

Preparing for the Revolution: Information Technology and the Future of the Research University By the National Research Council (2002). An extensive analysis of the impact of information technology on universities. A short section of the executive summary is below. More information at <http://books.nap.edu/books/030908640X/html/index.html>

The ultimate goal is to expand and strengthen the research university’s intellectual resources and institutional infrastructure not only to manage the anticipated transformation but to lead it. This will require a commonality of understanding among members of the university community (administrators, faculty, students), between disciplines, and between the university and its key external constituents (governing bodies, state governments, federal agencies, and foundations). Such a dialogue can help the research university not only to survive the coming era of rapid change as a vital American institution but to fulfill its traditional roles of education, research, and service more effectively and in as yet undreamed-of ways.

They conclude, in the implications chapter, with “This chapter provides an overview of the unprecedented technology-driven challenges currently being faced by higher education, and by the research university in particular. These challenges are sufficiently great that even the worst-case scenario – the end of the university, an institution that has existed for a millennium and truly become “an icon of our social fabric” – appears to some to be a distinct possibility. The reasoning

behind such an extreme prediction is that although the university has survived earlier periods of technology-driven social change with its basic role and structure more or less intact, the changes being induced by information technology are different because they alter the fundamental relationship”

Over the years there have been a number of studies either by the state, private/non-profit groups, consultants, or the universities. They have had different titles to fit the times when they were published, but most are focused on economic development defined broadly (e.g., education and infrastructure are part of building support for economic development). Some of the more recent reports are listed here.

### **Governor’s Strategic Planning and Economic Development (GSPED)**

Began in the early 1990s as a private initiative to develop a strategic plan for Arizona, the effort was converted to GSPED in the late 1990s. The clusters continue to operate in Phoenix and Tucson, but much of the statewide effort has been subsumed by the high technology activities currently underway. As of 2004, the clusters and foundations are below. More information at [http://www.azcommerce.com/gsped/gsped\\_clusters.asp](http://www.azcommerce.com/gsped/gsped_clusters.asp)

- Clusters (11): bioindustry, environmental technology, food/fiber/natural products, high technology, minerals and mining, optics, plastics and advanced composite materials, senior industries, software and information, tourism, and transportation/distribution.
- Foundations (7): capital, human resources, information and communications, infrastructure, physical infrastructure, quality of life, tax and regulation, and technology

### **Governor’s Council on Innovation and Technology (GCIT)**

The GCIT was established by the governor after the Arizona Board of Regents modified its commercialization policies and Proposition 301 funding became available for the universities to accelerate their commercialization programs. The council recommended in 2000 a multi-year roadmap that incorporates the universities, private enterprise, state and local government to foster a diverse technology industry base in Arizona. More information is available at <http://www.gcit.az.gov/>

- Spearhead passage of the tech commercialization constitutional amendment
- Support continuing evolution of university culture to emphasize innovation
- Promote greater interaction and collaboration among Arizona universities and the private sector
- Build a stronger partnership between Arizona economic development organizations and university technology commercialization programs.
- Focus university technology development on “demand pull” technologies

### **Arizona Partnership for the New Economy (APNE)**

Developed by the governor as a public/private partnership. The final report was in 2001. More information is available at <http://www.azcommerce.com/pdf/apne/finalreport2001.pdf>

Recommendations are identified under seven areas:

- Broadening connections to new communications tools
- Broadening connections to knowledge
- Broadening connections to new economy jobs
- Broadening connections to government information and services
- Deepening commitments to R&D, entrepreneurship and capital
- Deepening commitment of marketing Arizona as a new economy “hot spot”
- Deepening commitments to building creative communities.

### **Morrison Institute Studies (Arizona State University)**

The Morrison Institute for Public Policy, established in 1982, issues reports dealing with public policy issues in Arizona.

#### *1. Five shoes waiting to drop on Arizona’s Future (2001)*

This publication is part of a longer series on “policy choices for the new economy”. The five key issues facing the state are (more information available at <http://www.asu.edu/copp/morrison>):

- A Talent Shake Up – We think we’re good at attracting brain power. But we’re not as good as we think we are.
- Latino Education Dilemma – Latino youth are upwardly mobile already. But they need better education.
- A Fuzzy Economic Identity – Arizona is growing high-tech jobs. But we haven’t yet met the challenge of ensuring that we can excel in the new economy over the long term.

- Lost Stewardship – Leadership has become a spectator sport in Arizona.
- The Revenue Sieve – Arizona's tax system is old and full of leaks.

## 2. *The Coming of Age: 4 Scenarios for Arizona's Future (2002)*

A background report for a report on health and aging. Each scenario is several pages and includes trends and issues appropriate for Arizona (it is very well done).

- Boomers Bust the Budget
- Technology Enhances the Good Life
- Who Will Be Able to Afford the Future?
- Arizona Takes Charge

## 3. *Strategies to Improve Arizona's Standing in Science and Technology (2003)*

What would smart, sustained investment in a high tech future look like in Arizona? The examples of four competitor states suggest that Arizona needs:

- Lasting, enthusiastic leadership that recognizes the economic value of science and technology
- The right message and strategy to convey the urgency of this matter
- Investment in the creation and sustenance of first-tier research institutions
- More and better mechanisms to improve the transfer of ideas into the marketplace
- A belief that the state can be a leader in science and technology

## 4. *The New Economy: Policy Choices for Arizona (2000), an update to The New Economy: A Guide for Arizona (1999)*

- Technology is a given
- Globalism is here to stay
- Knowledge builds wealth
- People are the most important raw material
- There's no such thing as a smooth ride
- Competition is relentless
- Alliances are the way to get things done
- Place still matters—but for different reasons

## Arizona Town Hall Reports

Arizona Town Hall (1962-2003 topics of most frequent review). The topics below are based on a grouping of Town Hall sessions held 1-2 times a year. The topics are based on a vote of the membership, which numbers about 1500 and is made up of opinion leaders in Arizona. List is alphabetical. More information is available at: <http://aztownhall.org/>

- |                    |                  |
|--------------------|------------------|
| • Crime/Justice    | • Governance     |
| • Diversity/Values | • Health         |
| • Economy          | • Leadership     |
| • Education        | • Transportation |
| • Environment      |                  |

## Arizona Board of Regents Strategic Directions

The Arizona Board of Regents provides general guidance to the universities in the format of a strategic plan. These six strategic directions are from the 2005-2009 Strategic Plan.

- Increase Student Participation in University Education
- Enhance the Quality of Student Education
- Increase Affordable Education for Students
- Provide an Educated, Competitive Workforce:
- Enhance Research and Impact Economic Development:
- Optimize University Resource Acquisition and Work Environment:

The ABOR "Changing Directions policy (2002) allows (or directs) the universities to become more entrepreneurial and relaxes the pressures for the three campuses to follow the same rules in some areas e.g., (focus, admissions). More information at [http://www.abor.asu.edu/1\\_the\\_regents/initiatives/changing\\_directions/changing\\_directions.html](http://www.abor.asu.edu/1_the_regents/initiatives/changing_directions/changing_directions.html)

## **Battelle Memorial Institute Study for Arizona Board of Regents**

From 2002-2004 Battelle prepared a series of reports for the Arizona Department of Commerce and the Arizona Board of Regents as part of the Arizona Statewide Economic Study (more information available at <http://www.azcommerce.com/Economic/default.asp> , additional profiles on specific Arizona counties at [http://www.azcommerce.com/Communities/community\\_profiles.asp](http://www.azcommerce.com/Communities/community_profiles.asp))

1. Arizona Bioscience Roadmap (Prepared by Battelle) – (2002)  
[http://www.flinn.org/docs/Arizona\\_Biosci\\_Roadmap\\_revised\\_540.pdf](http://www.flinn.org/docs/Arizona_Biosci_Roadmap_revised_540.pdf)

“The Roadmap Alliance lays out a comprehensive action plan to position Arizona as a major southwestern state in the biosciences. Overall, this Roadmap proposes a bioscience agenda based on private sector market-driven needs, and recommends actions that are implemented around filling private sector gaps through private-public partnerships, led by industry.”

2. Positioning Arizona’s Research Universities: Science and Technology Core Competencies Assessment (Prepared by Battelle) – (April 2003)  
<http://www.azcommerce.com/doclib/PROP/final%20april%20AZ%20Core%20Competency%20ExecSum.pdf>

Six core competencies are: Ecological Sciences, Agriculture and Plant Sciences, Space Sciences, Computer Modeling & Simulation, Electronics & Optics, and Chemistry & Materials.

Battelle identified three technology platforms for operationalizing these core competencies:

- Bioscience (e.g., genetics, diseases, bioengineering, agbiotechnology, health, neurosciences)
- Advanced Communications and Information Technology (e.g., embedded technologies)
- Sustainable Systems (e.g., water, natural resources, environment, agricultural sciences, health, energy)

When these are combined with the biomedical competencies (defined within the Arizona Bioscience Roadmap) you get: information technology and communications, sustainable systems, bioengineering, neurological sciences, and cancer-therapeutics.

### 3. Bioscience Vision

From: Arizona Bioscience Workforce Strategy:  
Preparing for the Future October 2003

Arizona will succeed in its bioscience workforce development efforts by establishing a demand-driven bioscience workforce approach that broadly emphasizes access to bioscience careers for Arizona residents.  
[http://www.azcommerce.com/doclib/PROP/AZ\\_bioscience\\_rpt%20exec%20sum.pdf](http://www.azcommerce.com/doclib/PROP/AZ_bioscience_rpt%20exec%20sum.pdf)

### 4. Sustainable Systems Vision (Prepared by Battelle) for 2014

From: Positioning Arizona for the Next Big Technology Wave: Development and Investment Prospectus to Create a Sustainable Systems Industry in Arizona – March 2004  
<http://www.azcommerce.com/doclib/PROP/SSExecSum.pdf>

Arizona, building on its existing strengths, has become a premier national and international center for “arid-lands livability,” employing sustainability principles for:

- Water management, from source to sink and back again
- Harnessing the sun for power, fuel, food, and medicine
- Sustainable manufacturing and knowledge-based renewable industries, including those based on natural resources, such as forests, agriculture, and waste products.

Arizona has policies and regulations for both urban and rural areas and a business climate that encourages sustainable operations by all segments of society, so that industry growth occurs in harmony with the environment. As a result, Arizona is the model for quality of life in arid/semiarid lands and exports sustainable systems and services worldwide, creating jobs and wealth for its citizens.

# About the University of Arizona and the College of Agriculture and Life Sciences

## Changing Constituents and Audiences

The audiences for the College of Agriculture and Life Sciences are more varied than any other academic unit at the university. The primary audiences are 1) students, 2) state and national scientific research audiences, and 3) users of university developed knowledge. It is especially important to recognize the mixture of audiences and the different needs each has relative to the capabilities of the College of Agriculture and Life Sciences. As the major component of the land grant nature of the University of Arizona, the college has unique obligations to the people of the state.

### *Traditional CALS Audiences*

- Agribusiness
- American Indians
- Arizona citizens
- Associations and professional organizations
- Business/Industry/Retailing
- Civic and religious groups
- Community leaders
- Conservation groups
- Economically disadvantaged people
- Elderly
- Elected officials
- Farmers and ranchers
- Governmental agencies
- International and domestic geographical areas
- Medical agencies
- Minority groups
- Parents
- Planning commissions
- Public and private schools
- Research and educational institutions
- Rural communities
- Single parents
- Specialty groups
- Students, perspective students, and alumni
- Urban groups
- Youth

### *Possible New Audiences*

- Healthcare industry
- Hispanic communities
- Life Sciences industries
- Organizations (as partners)
- Owners of pets and companion animals
- Other....

## Issues Raised by CALS Faculty and Staff Feedback Process

Meetings/discussions were held with the Faculty and Staff Councils, Executive Council, and the Dean's Advisory Council. In addition, all faculty, staff, and unit administrators were asked to participate in an on-line questionnaire about issues and opportunities facing the college. In general there was a good deal of consistency in the responses. The major items include:

- Design new courses and majors to attract students (targeted to UA undecided majors)
- Maintain traditional programs because of unique role CALS plays in state.
- Seek new activities based on student interest, state needs, and college expertise.
- Be aware of the role Indian lands and water will play in the future of production agriculture.
- Restructure faculty funding, rewards structures, and faculty flexibility to move with the times.
- Need to decide our values and principles and not forget the historic role of a university.
- Emphasize hybrid learning – using a variety of methods and offering flexibility to students.
- Recognize county offices and faculty/staff are an extension of the college for multiple purposes.

- Build on our existing expertise at forming partnerships and cooperatives with new college audiences and in new ways.
- Recognize the continual need for good communication and to understand the impacts that reductions in the number of employees have on the increased workload for many remaining employees.
- Budgets will dictate much of what we can do by the total amount and how it is distributed for use.
- Increasing interest in border issues, rural-urban interfaces, water/Indian lands.
- Addressing our potential loss of “publicness” as competition and privatization increases.
- University and college and communication is important for morale and efficiency.

There was a general feeling that we would get smaller, have more diverse funding sources, use a mix of educational delivery methods, have new majors, new partnerships, and be more diverse. There was also some discussion of the need to really address issues relating to curriculum and ways of having students and others learn by looking at the big picture rather than by ad hoc fixes. This is similar to zero based budgeting for the financial area – rebuild the curriculum (and majors) from a fresh perspective that focuses on future needs.

## **University of Arizona Strategic Plan and Focused Excellence**

Each year the universities in Arizona must update their five year strategic plans. The current draft plan (submitted to the Arizona Board of Regents in August 2004, to be final in January 2005, for the period FY 2006-2010), resulted in a major change of the previous plan. The most recent version can be found (during fall 2004) at: <http://ipass.web.arizona.edu/currentspdocs.html>

Significant revisions were made in the mission, vision, and values, the overall tone, and strategic priorities. The plan uses the “concept of focused excellence” (see below for further explanation of the term) to leverage limited resources. This would take place within the colleges as well as at the university level. While there were early discussions of subjects for focused excellence, the university strategic plan does not identify such areas, but assumes “well articulated areas of focused excellence” will help guide resource investment. The CALS strategic plan was developed to be in concert with these revisions but be more specific in focusing in specific areas and providing guidance to navigate the future. Thus, CALS uses the same mission, vision, values, and goals found in the university strategic plan. However, we go further to identify five strategic issues facing the college, five specific areas of focused excellence, five characteristics of the future applicable to all the focused excellence areas, and six program areas (that organize the individual administrative units in a way to address the future).

In 2003, University of Arizona President Peter Likins announced the focused excellence initiative. More information is at <http://president.arizona.edu/initiatives/focused-excellence/> and <https://w3.arizona.edu/~provost/studyteam/index.html>

President Likins defined focused excellence as characterized by three essential elements:

- Managed growth
- Focus on fewer academic programs
- Prioritization based on excellence, which includes diversity, as the primary criterion for investment.

Focused Excellence also includes some of the impacts of the above three elements, and is not the simplistic view some have taken, although the concept itself is simple. There has been a lot of publicity about the four areas (see below), but the concept has important additional considerations. These include:

- Implementing the focused excellence themes throughout the university,
- Eliminating or merging selected programs to allow more focusing toward the themes
- Restructuring support services to provide for the selected excellence areas

For example, to have a good science focus, you need good supporting academic departments (e.g., math) and technical units (e.g., computing), and the supporting departments and units need to be selective in what they do rather than too broad. Thus, academic departments would be expected to support the four themes and also address some of their disciplinary leading edge research but in the appropriate proportion. In addition, while is not stated, specific aspects of the focused excellence themes also need to be supported by a needs from the various audiences of the themes.

### *1. Cognitive Science and Neuroscience*

The study team identified critical needs in: 1) fundamental mammalian neuroscience, 2) neuro imaging, and 3) computational cognitive science. Areas of potential growth include: 1) aging, 2) development, 3) cognitive and neural engineering, and 4) affect.

### *2. Cultural, Ethnic, Gender, and Area Studies*

A focus on border studies takes advantage of current UA strengths, where borders are defined as: 1) geopolitical borders, 2) university/community borders, 3) borders of language, culture and identity, and 4) disciplinary and academic borders

### *3. Earth Sciences and Environmental Programs*

The study team defined the question as: How shall the growing population and its life-supporting environment be sustained in the context of diminishing resources (e.g., ecosystem diversity, water availability and air quality)? The defined seven specific topics for focus: 1) water sustainability, 2) earth surface processes, 3) natural resources and hazards, 4) hydrometeorology and climate, 5) biogeochemistry and ecosystem dynamics, 6) environment and society, 7) environment and health, and 8) engineering for a sustainable environment.

### *4. Life Sciences*

The study team defined four focal areas based on current strengths: 1) genome and proteome structure, function and evolution, 2) quantitative, computational biology and engineering biosystems, 3) diversity of organisms, and 4) molecular medicine.

Each focal area has five crucial features:

- Correspondence to a dynamic scientific frontier expected to result in major breakthroughs within the next decade
- Strong promise for improving human welfare
- Major potential for rejuvenation of teaching programs at undergraduate, graduate and professional levels
- A foundation of excellence at the UA
- An interdisciplinary nature that requires involvement of multiple subdisciplines within different administrative units of the university.

CALS has clear very strong relationships to the Earth Sciences and Environment Program and the Life Sciences Program. CALS also has potentially strong relationships to the Cultural, Ethnic, Gender, and Area Studies area, depending on how one defines some of the terms in the study team report.

## **University of Arizona Proposition 301 Funding (TRIF)**

Proposition 301 was approved by Arizona citizens in 2000; it is also called the Technology Research Initiative Funding (TRIF). It provides for an increase of 0.6% in sales tax over a 20 year period. Its purpose is for a series of education related expenditures, with the portion for universities to be used to invest in technology and research-based initiatives. The universities could identify their priority areas for support by these funds; the UA subject areas of support include seven areas:

- Technology Transfer Infrastructure
- Biotechnology
- Information Technology
- Optics
- Water
- Math/Science Teacher Prep
- Access

## **Joint Campuses and Pending Studies for the Arizona Universities**

The three state universities (Arizona State University, Northern Arizona University, and the University of Arizona) have formed partnerships and joint campuses to improve efficiencies and service to constituents. Since 1987 NAU has had a presence on the Arizona Western College (Yuma) campus. This allows upper division classes to be taken through NAU) and lower division courses through AWC, with a result that Yuma residents can get a 4-year education and not have to leave home. The College of Agriculture and Life Sciences began teaching our specialized courses in Yuma, both on-site at AWC and via distance education (including some CALS faculty located in Yuma to teach classes to the Tucson campus via distance education. We therefore can offer a bachelors degree in Agriculture, jointly with AWC and NAU to Yuma residents. In 1996 a tri-university Master of Engineering degree was developed (using the three state universities to provide

one degree to the student). Additional joint degrees from the three universities now include a Nursing (PhD) and mathematics and science teacher certification. In addition, there are a considerable number of electronic courses available through the Arizona Regents University (<http://www.azdistancelearning.org>).

More recently, a downtown Phoenix technology/medical campus developed. While this downtown site was initially with the Translational Genomics Research Institute (TGen), and affiliated with the three Arizona public universities, the site is expanding. In 2004 the downtown campus was renamed the “Phoenix Biomedical Campus”, where the UA will relocate and expand its existing Phoenix College of Medicine presence by fully developing a research grade medical school so medical students can do all their course work from Phoenix, with on-site faculty and instruction and some distance education through the Arizona Telemedicine Network. ASU and the UA also are planning research facilities to operate jointly by the UA and ASU through the Arizona Biomedical Collaborative. In addition, the ASU College of Nursing will be relocated to this campus and the UA College of Pharmacy will have a presence. The College of Public Health at UA, while located in Tucson, has the formal name of Arizona College of Public Health.

Studies are underway to determine how the Arizona public universities should be governed (the Arizona University System Redesign Project), and to review the Arizona Regents University (an ABOR coordinated device to take existing electronically delivered courses from all three of the Arizona universities).

## **Overview of Characteristics of Changes Shaping the Future**

These characteristics or themes describe another perspective on how we can look at the world. The driving forces use familiar classification terms, the other studies described above use still different terms. These characteristics about the future partly emerge by studying the driving forces and other studies in depth. But they also emerge from looking at the world from a future perspective rather than our more familiar classification categories. In most cases, they cross all the driving force categories and should be thought of as a way of addressing each of the specific trends within the driving force categories.

### *1. Sustainability*

Sustainability is likely to be the next defining era (like technology defines our current era). It is pervasive through all driving force topics and is generally defined as doing something today with the long term perspective in mind so you are able to continue doing it a long time without burdening future generations. Examples include strategic planning, workforce development, life long learning, health, security, infrastructure, spending/investment, building/maintenance, and organizational behavior (including ethics and quality).

### *2. Globalization and Regionalization*

The world is more interdependent through the economy/trade/marketing and because of ease of access through travel or internet. While keeping national culture and local options, nations become part of the world as a whole and thus require world-wide efforts at governance, treaties and collaborations.

### *3. Personalization and Collaboration*

Increasingly people will want both personal service (rather than generic relationships) and ways of obtaining products or services that are unique to the person requesting it. This changes the relationship of the organization to the individual, as employee or as customer. Collaboration includes informal activities or formal partnerships or alliances. They occur within an organization, among organizations, or among people without the intervention of organizations. Collaboration values differences in people and their perspectives, with the effort in developing the collaboration offset by the better results the group produces. Both are needed.

### *4. Complexity and Simplicity*

Everything is getting more complex, with more choices, and people look for simplicity. Some solutions are indeed simple, and some new technologies can take the complexity and hide it, so the solution appears simple. Both simplicity and complexity are likely to be guidelines for the future.

## 5. *New Approaches and Tools*

There are many new possibilities for addressing all the driving force categories, and we have a new toolbox of devices to help do this, with many more tools and approaches yet to be discovered. Dealing with the unfamiliar is both exciting and worrisome and different people and institutions deal with the change in different ways. Conflicts in these different approaches to new possibilities will exist and need to be worked out. Often the solutions will be ‘hybrids’ where you have some of the older ways and some of the newer, each bring its particular strengths to the solution.

## **Putting it All Together**

### ***Near Certainties, Uncertainties and Wildcards***

#### **Near Certainties**

Even the best extrapolations of a trend, or estimates of when a trend will change, are likely to be off target. Constant monitoring of important trends can minimize negative impacts, but uncertainties still have to be assumed to occur and plans made to account for that fact. In addition, the themes above give further guidance to near certain activities.

While you cannot predict the future, some changes will have large impacts and are highly likely, and therefore they are near certainties. These examples should be thought of in the context of the traditional driving force categories and themes listed in section 3.

#### *1. Increased Diversity and Cultural Transformation*

- Interactions among several “dominant” cultures impact the country’s culture and values. While traditional values will largely remain with individuals and their affinity groups, the dominate culture of the country will likely become a hybrid of the represented cultures. The term “traditional values” will take on a new meaning.
- Communicating in a new language and understanding and responding to cultural differences in the workplace along with an increased role of minorities in society and increased political and marketing influence.
- Global interactions may be eased as the diversity of the US increases and brings new cultural representatives into the sphere of influence.

#### *2. Aging and Migrating Populations*

- Increasing dependency ratio (working portion of population supporting young and old) strains support systems.
- Labor supplies shift as baby boomers leave the workforce and management positions or delay retirement past 65.
- Value systems shift as new cultures gain influence and generations change, younger generations don’t learn the basic crafts of the older generation while there is still demand for those skills.

#### *3. Infrastructure Constraints Become More Evident*

- Transportation planning and maintenance, water supplies and waste management gain complexity with larger populations concentrated in cities.
- Energy grids become modernized and move to more redundancy, with alternative sources of energy increasing. Energy efficiency takes on a new focus and life cycle costing coupled with a longer term outlook drives decisions in this direction.
- Communications/electronic infrastructure is more vulnerable to technological obsolescence and sabotage than physical infrastructure but takes an increasingly important role in the functioning of society.

#### *4. Government Services vs. Taxes: Financial Impact in 2010-2015 Period*

- Baby boomers retiring, immigrants influencing legislation, public and private debt levels, and debates on taxes and services lead to a readjustment in the way we do everyday things.
- Definition of wealth changes and includes several components in addition to money.
- Addressing the disparity in income levels between countries and within in countries (the rich/poor gap).

#### 5. *World Order and Polarization*

- Conflict through partisan political roles or because of strongly held values has made governing inefficient and ineffective. This will get sufficiently severe that corrective actions will develop.
- Seeking the best solution (from a particular viewpoint) will give way to a recognition that there are often multiple “right” answers and being “good enough” may be sufficient and be more efficient and effective in the long term.
- World-wide institutional structures are needed to address the global economy and complexity of operating in an interconnected world. The changes in such structures will cause a disruption in the “pecking order” of countries and institutions.

#### 6. *Personalized Connectivity*

- One-to-one interactions between anyone with anyone, at anytime, worldwide, will potentially empower people to organize without the need for institutional infrastructure. This may cause an influence shift from established organizations and powerful people to those who can organize affinity groups around particular issues.
- This level of personalized connectivity impacts how organizations function, including the manufacturing, service, educational, and leisure sectors.
- Technology (computers and internet) allows anyone to be an editor and publisher, creating multiple information sources that may or may not be accurate but are easy for publishers to publish and readers to find and reinforce the reader’s perspectives.

#### 7. *Institutions as We Know Them Will Change*

- Institutions of all types will be impacted by the other near-certain changes (including government, business, education, non-governmental organizations, and community organizations).
- Drivers of the change include: longer term outlook, employer-employee relationships, communications, ethics, accountability, private gain but also public good,
- New approaches to existing problems (for example, developing transferable medical plans modeled after the 401K retirement plans, where they are transportable across different employers, remain the same for the employee, and are paid for by both the employer and the employee).

#### 8. *Sustainability*

- As technical or economic limitations on traditional energy supplies become more evident, shifts will be made to accommodate sustainable practices, including efficiency programs and alternative sources.
- Global climatic change mitigation measures are increasingly being considered worldwide, and will cause adjustments in our energy use patterns, causing impacts in a number of economic sectors.
- Organizational missions and strategies will adjust to embrace sustainable practices in management and manufacturing. Governments will work toward sustainable cultures and infrastructures. Non-governmental organizations will develop guidelines for sustainable development, green building practices, and design. These efforts will improve efficiency and effectiveness as well as save resources and improve interactions with workers and customers.

#### 9. *Technology: A Major Driving Force of Change*

- Major possibilities in biology, information technology, and materials are enormous. Some of these possibilities can be visualized today and others cannot.
- Very small and very smart devices, coupled with communications can be used to revolutionize many service activities (such as health care, building management, service industries, and shipping).
- Integration of these technologies into organizations will have major impacts on workers (type and number), costs, and services provided. The full extent of the possibilities is not clear today.

### **Uncertainties**

Most of the driving forces, trends and themes have uncertainties associated with them. For example: How fast will a trend move? Will it rise to a certain level, crash and burn, or level off? How will the various trends interact with one another? How will growth rates (in population, economy and innovation) in other countries affect the US (especially India and China, the two largest countries)? How will taxes vs. services and private vs public good conflicts be

resolved? How and when will the initial impacts of global climatic change occur? How will the concern over terrorism (physical, biological, electronic) impact our abilities to function?

How will the definition of quality of life change? Will there be world peace? What natural disasters are most likely at which locations, and how can they be mitigated against? How will we deal with the impacts of global climatic change? What will be the modern equivalent to World War III, and how many parts of society will it impact? Some uncertainties include:

1. **Technology and Work** – How does the work environment change (blue and white collar, inside the US and outsourcing or importing) as a result of technology and wage/benefit scales? How will automation (knowledge management and robotics) impact jobs available for humans?
2. **World Order** – Which country (or group that does not represent a country) will be the dominant world force (this does not necessarily mean military force, but could be economic or social/moral)? What form will a world body take (for example, the United Nations system, which includes many agencies and commissions such as: the World Trade Organization, the International Monetary Fund, International Court of Justice, International and Atomic Energy Agency) to address 21<sup>st</sup> century realities? Is world peace possible and under what conditions? Is war moving from an objective of winning over a country or new land or to winning an ideological battle where portions of many countries are involved?
3. **Environment and Economy** – What form will the international economy take? How will it be affected by population growth in less developed countries?
4. **Government Services vs. Taxes** – What are we willing to pay and for what service? Who decides? How will the major political parties differ in 10 years? How do they differ today from when they originated? How will the growth of federal entitlements and specialized tax incentives/loopholes be changed?
5. **Rich and Poor Gap** – There are gaps (income, health care, jobs, education, productivity) between the more developed countries and the less developed countries and there are gaps within in countries of both types. How great can the gap get before there is a corrective mechanism (or an over-correcting mechanism)?
6. **Global Climatic Change, Energy, and Water Resources** – When will global climate change effect practical consequences on the world economy and environment? What form will the effect take and how will we mitigate against it? Current energy supplies are not economically sustainable, what new energy sources and conservation moves will be the most cost effective, socially acceptable, and technically feasible?, Potable water is in short supply worldwide; will there be new sources (recycling, seawater) or will there be more conservation?

## Wildcards or What Ifs

Wildcards are the unexpected events that might occur. Those that have a high probably should be planned for, but there are others that will just occur or an anticipated timing may occur early. They can take the form of What If.....

Examples are:

- Dramatic energy costs increase or water supplies decrease to shift more costs to providing basic needs.
- Decrease in litigation with increase in mediation restructures the legal world.
- Trade wars and embargos cripple the global society.
- Terrorism slowly, simply, and methodically attacks developed societies, effectively eliminating them.
- US average life expectancy increases from 74 for males and 79 for females (2004) to 100 by 2050.
- A series of natural disasters hits major population centers in rapid succession (earthquakes, hurricanes).
- A major stock market collapses, bringing down all interrelated stock exchanges worldwide.
- Regional urban centers are developed under the ocean.

Some wildcards are relevant for everyone, but others are dependent on the type of institution (yours or one you interact with) and which societal sector

## **General Observations**

People will have more personalized choices. They will become more information literate and self sufficient in some things and more reliant on others for more complex things, often combining these two approaches (for example, learning about their medical problem then consulting with a professional for advice). People (in and out of organizations) will collaborate more for personal or business interests, bypassing much of the existing bottlenecks.

As complexity increases and populations become more concentrated in megacities, and the unanticipated impacts (positive and negative) of new technologies and cultural conflict become evident, we will find new types of risks and new ways of mitigating them. Some of these changes will impact on people's personal choices or values and we can expect debates on the "public good" vs. "private desire".

We often hear that people resist change, but it is also accurate to say it is human nature to change (that is, try new things, better yourself, learn). What people resist is change they do not understand or that affects them in a negative way. Understanding more about how we can anticipate the future will minimize our transition.

### *1. Our employees and our audiences are changing*

- The Indian communities have a significant amount of land, increasingly agricultural, and water. Do we maintain level of effort or increase it? Production agriculture will continue to decline and new audiences are required to replace it.
- How do we decide what audiences to go after? Those that need information, those that have money, those that can influence others? How do we communicate consistent messages and appropriately?
- How do we continue to focus on agriculture (because that is our role and we need the external support) while continuing to move resources and internal faculty lines to other needs?
- With the changes underway, whether or not we develop a new strategic direction document, they will cause some heartburn to employees. Should we have a plan on dealing with change, improving morale of employees, and working with declining existing clientele, as well as new (to us) clientele?
- How can we maintain employee morale given their increase in workload – how much will additional communication and improved evaluation procedures help?

### *2. Collaboration will increase*

- We have a long history of working with groups of various types, including cooperatives within the agricultural area. It will be increasingly important to work with others.
- How can we build on our expertise with various groups to assist the university, and can we work with new groups using similar methods?
- Following clarification of our focus, we should begin building these relationships. Is our organizational structure adequate for building and supporting these relationships?
- How should we change our relationship with traditional audiences? Do they have to pay to get something special or face-to-face meetings, but can get lots of information via internet?
- The UA has too little coordination on areas relevant to us: environment, water, border-related issues. They are getting pretty good on diversity and bioscience. How can we take advantage of this campus fragmentation?

### *3. Organizational structure and decision making may need adjustment*

- What changes should be made in formal units and cooperative agreements/partnerships?
- What data do we need to begin collecting to measure progress (in a new way) and what principles should we define for key decisions such as program/project approval/disapproval and resource allocation?
- How do we maintain agility and flexibility within the university structure, and allow for temporary (perhaps several years) topics before dropping them and moving on to others.
- Are we structured to handle these changes?

### *4. Our teaching/research/extension relative focus on various subjects is not all aligned.*

- It should not be aligned because each has different roles, but are we prepared to state this in the strategic plan?

### *5. We should increase our recruitment of students.*

- How will the increase in Hispanics affect this? How will extension offices be used to serve as mini-CALS sites in rural communities?
- How can we modify some of our majors to be more attractive to UA students that have not selected a major?

6. *What is our future involvement in information technology/communication?*

- Over 70% of the US population now uses internet. The UA is not planning to emphasis distance education (but ABOR, NAU and ASU are).
- What should we be doing in distance education to our student's community colleges and others in Arizona? How should we work with other institutions to build comprehensive programs but without us making all the effort?
- How can extension more effectively use the internet? How will we integrate into the developing national e-extension system?

7. *Technology is increasingly changing the ways we do basic activities.*

- Rather than simply automating them (that is, making them faster or more accurate), we are changing the very nature of what we do and how we approach it.
- This not only makes it hard to forecast possible changes in the future, it affects nearly everything we do, so almost everyone will be impacted either directly or indirectly.
- Institutions and organizations will be most affected because of their critical involvement with other components of society.
- Most of this technology will be seamless and not seen by the individual.

8. *Demographic trends and cultural changes is another large driver of these changes.*

- Diversity is increasing and the dominant groups are shifting, causing cultural shifts and impacting people's value systems.
- Long held values are often not recognized because we have grown up with them, but they are still being challenged, and this will cause conflict and tension in society, institutions, and among individuals.

## **Opportunities**

Today's educational climate makes it important to determine our competitive position in comparison to other institutions vying for students, research funding and faculty/staff. By reviewing external trends, internal strengths, and unique features of the College of Agriculture and Life Sciences and its location, we also should expect to find some special opportunities (which will vary over time). Several special opportunities exist because of the unique characteristics of the university, including the following:

1. *New Audiences.*

As traditional (especially production agriculture) audiences tend to diminish, new audiences will increase to fill the gap. For example, the major changes in biological activities and the current societal concerns such as child and spouse abuse, water quality, and food safety require expertise presently existing in the College of Agriculture and Life Sciences. Additional clientele will be found in the tourism, environmental, and natural resource areas (where again the college exhibits strength).

2. *Capitalize on Geographical Location.*

The college, situated in a unique arid or semi-arid region that resembles many countries throughout the world, has the opportunity to become a "Center of Excellence" in programmatic efforts in concerns such as water, southwest culture, semi-arid lands, and environment.

3. *Collaboration.*

Additional cooperative ventures on the regional level, among other land grant universities, can be developed for teaching, research, and extension programs. Similar efforts can be increased with more interdepartmental and intercollege activities within the university.

4. *New Thrusts*

Building on the reports listed above, there are selected areas where we have expertise and there is an identified need. These are listed below under Strategic Choices.

5. *Curricular Revisions and New Approaches to Learning.*

Greater efforts at student recruitment coupled with revised programs that are relevant for current and future students (traditional and other). Courses take on a hybrid character – using the classroom and electronic means in mixes appropriate to the particular student interest and subject.

## **Conclusions**

We are at the beginning of a major change period. A number of factors are involved. Technology has been the big driver for the last 20 or more years and will continue to be a large factor. Sustainability is posed to become the next driver (broadly defined to include organizations, world order, resources, health, income). Transitions to new eras do not always go smoothly but they give ample opportunities for those that see the positive in such transitions and are prepared for the process. These changes will be manifested with new rules (written or unwritten) that allow for redefining common terms such as return on investment, cultural norms, safety, and privacy. Because of the increasing interactions and complexity, there will be interest in making things as simple as possible (but not too simple, as Einstein once said), and the role of different types of organizations in society may be changed, especially as individual people increase in their ability to, in part, function like organizations.

Technology is increasingly changing the ways we do basic activities. Rather than simply automating them (that is, making them faster or more accurate), we are changing the very nature of what we do and how we approach it. This not only makes it hard to forecast possible changes in the future, it affects nearly everything we do, so almost everyone will be impacted either directly or indirectly. Institutions and organizations will be most affected because of their critical involvement with other components of society. Most of this technology will be seamless and the technical details are not seen by the individual.

Demographic trends and cultural changes is another large driver of these changes. Diversity is increasing and the dominant groups are shifting, causing cultural shifts that impact on people's value systems. Long held values are often not recognized because we have grown up with them, but they are still being challenged, and this will cause conflict and tension in society, institutions, and among individuals. Ageing populations in the more developed countries and younger populations in the less developed countries shift the balance of dependence on the working age population.

People are becoming more information literate and self sufficient in some things and more reliant on others for more complex things, often combining these two approaches (for example, learning about their medical problem then consulting with a professional for advice). People (in and out of organizations) will collaborate more for personal or business interests, bypassing much of the existing bottlenecks or costs. This affects the infrastructure of commerce and governance that we are accustomed to.

As complexity increases and populations become more concentrated in megacities, the unanticipated impacts (positive and negative) of new technologies and cultural conflict will become evident. We will find new types of risks (broadly defined) and new ways of mitigating them. Some of these changes will impact on people's personal choices or values and we can expect debates on the "public good" vs "private desire." The relatively rapid growth rates of less developed countries, coupled with new communications options, and new definitions of war, raise the question of how the world will interact and which countries will have the greatest influence in 20-30 years.

We often hear that people resist change, but it is also accurate to say it is human nature to change (that is, try new things, better yourself, and learn). What people resist is change they do not understand or that affects them in a negative way. Understanding more about how we can anticipate the future will minimize our transition difficulties.

## Further Reading

Some references within the report text and others are in the “selected references for keeping up”. These references are for a broader analysis of some of the key points identified the report.

1. Coates, Joseph, John Mahaffie, and Andy Hines. 1996. *2025: Scenarios of US and Global Society Reshaped by Science and Technology*. Oakhill Press. 508 pages.  
This book is a little dated now, but it has much still useful information. It includes 107 assumptions about the future and identifies 15 scenarios for the world in 2025. The book summaries the results of specific studies for a number of science and technology companies, done by Coates and Jarrett consulting. His current web site includes a number of articles he has written on a range of topics about the future. <http://josephcoates.com/>
2. Peterson, Peter. 2004. *Running on Empty: How the Democratic and Republican Parties are Bankrupting Our Future and What Americans Can Do About It*. Farrar, Graus, and Giroux. 242 pages.  
Peterson was the Secretary of Commerce in the Nixon administration and has been involved in a number of efforts directed at balancing income and expenditures. The book has many specific examples, with numbers, about trends and their expected results.
3. Rand Corporation. 2004. *Shaping the Next One Hundred Years: New Methods for Quantitative, Long-Term Policy Analysis*, 213 pages. Full report available at <http://www.rand.org/publications/MR/MR1626/>  
An analysis of various techniques about studying the future, concluding that you need to “move past familiar shores”. They propose a complex computer model to generate thousands of scenarios that can then be assessed by humans (while the computer approach likely has more limitations than they cite, the analysis of techniques is good and current and the new possibilities worth reading).
4. Schwartz, Barry. 2004. *The Paradox of Choice: Why More is Less*. Harper Collins. 264 pages  
Making choices among many possibilities causes a “freezing” so no decision is made, or too much time is spent on trivial decisions and not enough on important ones. Schwartz is professor at Swarthmore College.
5. Schwartz, Peter. 2003. *Inevitable Surprises: Thinking Ahead in a Time of Turbulence*. Gotham Books. 245 pages.  
The “inevitable surprises” are the trends that many know about but not much is done about them in advance, so when they happen they come as a surprise. Schwartz gives a series of examples and identifies strategies to overcome the “surprises”. Schwartz is president of the Global Business Network. GBN has a book club (free) that includes a monthly reading list of books relating to the future, covering a wide range of topics. <http://gbn.org/BookClubDisplayServlet.srv>

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