Wave 5 of American Higher Education Evolution: The “National” Universities

21st Century Technology Enhanced Teaching and Learning Enterprises

Michael M. Crow
Arizona State University
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The 18th Century Ideal

“Wisdom and knowledge, as well as virtue, diffused generally among the body of the people, being necessary for the preservation of their rights and liberties; and as these depend on spreading the opportunities and advantages of education in the various parts of the country, and among the different orders of the people, it shall be the duty of legislatures and magistrates, in all future periods of this commonwealth, to cherish the interests of literature and the sciences, and all seminaries of them. . . especially the university at Cambridge.”

John Adams

Chapter 5, Section 2, Constitution of the Commonwealth of Massachusetts ratified in June 1780
Wave 1

America’s Greek Academies

Harvard 1636
Yale 1701
Pennsylvania 1740
Princeton 1746
Columbia 1754
Bowdoin 1794
Nor am I less persuaded that you will agree with me in the opinion that there is nothing which can better deserve your patronage than the promotion of science and literature. Knowledge is in every country the surest basis of public happiness. Whether this desirable object will be best promoted by affording aids to seminaries of learning already established, by the institution of a national university, or by any other expedients, will be well worthy of a place in the deliberations of the legislature.”

George Washington

First annual message to Congress
January 1790
Wave 2

America’s Areligious Greek Academies

University of Georgia  1785
University of North Carolina  1789
University of South Carolina  1801
University of Michigan  1817
University of Virginia  1825
James Smithson (1765-1829)

• British scientist who left his estate to the U.S. to create “an establishment for the increase and diffusion of knowledge.”

• Years of debate resulted in the rejection of a university in favor of the Smithsonian Institution.
Wave 3

New 19th Century Ideal –
Egalitarian Access and Practical Science

University of Wisconsin 1848
University of Minnesota 1851
Pennsylvania State University 1855
Iowa State University 1858
MIT 1860
Cornell University 1865
University of Illinois 1867
University of California 1868
Justin Smith Morrill (1810-1898)

The Morrill Act of 1862

- Established at least one college in every state
- “accessible to all, but especially to the sons of toil…” (serving the children of farmers and laborers)
Wave 4

New Emerging 20th Century Hybrid – British and German Models Combined

Points of Emergence

Johns Hopkins University 1876
Stanford University 1885
University of Chicago 1890
Wave 4

New Emerging 20th Century Hybrid – British and German Models Combined

From Wave 1: Harvard University
Columbia University
University of Pennsylvania
Princeton University

From Wave 2: University of Michigan

From Wave 3: University of California, Berkeley
Cornell University
University of Illinois
Wave 5

New Emerging 21st Century Integrated (socio/technical) Scalable Complex Adaptive University (Mega)

Point of Emergence

Arizona State University  2015-2020
Wave 5

New Emerging 21st Century Integrated (socio/technical) Scalable Complex Adaptive University (*Mega*)

<table>
<thead>
<tr>
<th>From Wave 1</th>
<th>None</th>
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<tbody>
<tr>
<td>From Wave 2</td>
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<td>From Wave 3</td>
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<td>From Wave 4</td>
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Public Value vs. Market

- **Public Value Success**: New American University (Adaptive, uses tech to increase quality and responsiveness)
- **Public Value Failure**: Emerging Innovation In Higher Education (Profit over Public Value, using technology to decrease cost, not increase quality)
- **Market Failure**: Traditional Public Research Universities (Rigid, Inflexible)
- **Market Success**:
Teleonomic Failure of the Scalable Market Driven “Universities”

Teleonomy, n.

*Biol.* The property, common to all living systems, of being organized towards the attainment of ends. Purpose and goal-directedness of structures and functions of organisms.

Oxford English Dictionary
Higher Education Evolution

- Wave 1: Greek academies
- Wave 2: German research universities
- Wave 3: Land grant universities
- Wave 4: American research universities
- Wave 5: New American University

Dimensions:
- Innovative vs. Conservative
- High Risk vs. Low Risk

Scale:
- Small Scale
- Large Scale
Design and Adaptation

Wave 1  Americanized British Colleges
- small, elite, classical
- separate
- not scalable

Wave 2  American Public Colleges
- 19th century elites
- 19th century teachers colleges and non-elites
- 20th century non-elites
- specialized public and a few privates
- community colleges
## Design and Adaptation

<table>
<thead>
<tr>
<th>Wave 3</th>
<th>Americanized Democratic University</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>de Tocqueville (practical)</td>
</tr>
<tr>
<td></td>
<td>Local, regional focus</td>
</tr>
<tr>
<td></td>
<td>Focus on the working class/</td>
</tr>
<tr>
<td></td>
<td>masses</td>
</tr>
<tr>
<td></td>
<td>Focus on science practice</td>
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<table>
<thead>
<tr>
<th>Wave 4</th>
<th>Research Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transformative American innovation</td>
</tr>
<tr>
<td></td>
<td>Inherent tension between missions</td>
</tr>
<tr>
<td></td>
<td>Large scale, but limited</td>
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</tbody>
</table>
The American Challenge

Size

Diversity

Speed of Change

Economics of the Model

Class Inequities
Progress at Scale

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ASU Charter

ASU is a comprehensive public research university, measured not by whom it excludes, but by whom it includes and how they succeed; advancing research and discovery of public value; and assuming fundamental responsibility for the economic, social, cultural, and overall health of the communities it serves.
Leverage Our Place
ASU embraces its cultural, socioeconomic and physical setting.

Transform Society
ASU catalyzes social change by being connected to social needs.

Value Entrepreneurship
ASU uses its knowledge and encourages innovation.

Conduct Use-Inspired Research
ASU research has purpose and impact.

Enable Student Success
ASU is committed to the success of each unique student.

Fuse Intellectual Disciplines
ASU creates knowledge by transcending academic disciplines.

Be Socially Embedded
ASU connects with communities through mutually beneficial partnerships.

Engage Globally
ASU engages with people and issues locally, nationally and internationally.
Design (n).

Purpose, planning or intention that exists or is thought to exist behind an action, thought or material object.

Design (v).

Do or plan (something) with a specific purpose in mind.
The ASU Pathway

A -------- B

A -------- B

C1 C2 C3 C4 C5
Share of Total Enrollment

Share of Total Degrees

Share of High Demand Degrees

Share of Research Expenditures

- 2024-25 metric
- 2019-20 metric
- 2014-15 actual
- 2008-09 actual
Financial aid and recruitment practices have resulted in substantial growth in enrollment of freshmen from families of lesser since 2002.
ASU is achieving its targets for degree production

Undergraduate and Graduate Degrees Awarded
Actual and Projected
Research expenditures have almost tripled in ten years and are tracking with the metric target.
ASU faculty perform at a very high level of productivity. 10-20% growth is required to achieve all of the metric goals.

**FTE Faculty Employees Per 100 FTE Students (Excludes Medical School Employees)**

<table>
<thead>
<tr>
<th>Institution</th>
<th>FY10</th>
<th>FY11</th>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
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</thead>
<tbody>
<tr>
<td>University of Maryland-College Park</td>
<td>9.77</td>
<td>9.99</td>
<td>10.3</td>
<td>10.31</td>
<td>10.36</td>
</tr>
<tr>
<td>University of Minnesota-Twin Cities</td>
<td>8.16</td>
<td>8.08</td>
<td>8.08</td>
<td>8.82</td>
<td>9.13</td>
</tr>
<tr>
<td>University of Washington-Seattle Campus</td>
<td>5.19</td>
<td>5.73</td>
<td>5.6</td>
<td>8.31</td>
<td>8.67</td>
</tr>
<tr>
<td>Rutgers University-New Brunswick</td>
<td>8.03</td>
<td>7.58</td>
<td>7.81</td>
<td>8.27</td>
<td>8.28</td>
</tr>
<tr>
<td>Pennsylvania State University-Main Campus</td>
<td>7.58</td>
<td>7.63</td>
<td>7.56</td>
<td>8.05</td>
<td>8.14</td>
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<tr>
<td>University of Wisconsin-Madison</td>
<td>5.87</td>
<td>5.8</td>
<td>5.71</td>
<td>9.14</td>
<td>7.63</td>
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<tr>
<td>Michigan State University</td>
<td>5.73</td>
<td>5.56</td>
<td>5.52</td>
<td>5.27</td>
<td>7.22</td>
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<tr>
<td>University of Connecticut</td>
<td>5.24</td>
<td>5.25</td>
<td>5.37</td>
<td>6.45</td>
<td>6.62</td>
</tr>
<tr>
<td>University of California-Los Angeles</td>
<td>6.03</td>
<td>6.07</td>
<td>6.97</td>
<td>6.51</td>
<td>6.38</td>
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<tr>
<td>Indiana University-Bloomington</td>
<td>6.38</td>
<td>6.45</td>
<td>6.42</td>
<td>6.57</td>
<td>6.35</td>
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<tr>
<td>University of Illinois at Urbana-Champaign</td>
<td>6.34</td>
<td>6.06</td>
<td>5.86</td>
<td>5.98</td>
<td>6.07</td>
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<tr>
<td>University of Iowa</td>
<td>5.62</td>
<td>5.66</td>
<td>5.82</td>
<td>5.77</td>
<td>5.79</td>
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<tr>
<td>The University of Texas at Austin</td>
<td>5.68</td>
<td>5.48</td>
<td>5.42</td>
<td>5.43</td>
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<tr>
<td>University of Arizona</td>
<td>5.46</td>
<td>5.66</td>
<td>5.71</td>
<td>5.41</td>
<td>5.66</td>
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<tr>
<td>Florida State University</td>
<td>5.04</td>
<td>4.81</td>
<td>4.74</td>
<td>4.93</td>
<td>4.96</td>
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<tr>
<td>Ohio State University-Main Campus</td>
<td>4.92</td>
<td>4.84</td>
<td>4.70</td>
<td>4.85</td>
<td>4.86</td>
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<tr>
<td><strong>Arizona State University</strong></td>
<td><strong>4.42</strong></td>
<td><strong>4.26</strong></td>
<td><strong>4.06</strong></td>
<td><strong>4.09</strong></td>
<td><strong>4.15</strong></td>
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<tr>
<td><strong>Peer Median</strong></td>
<td><strong>5.87</strong></td>
<td><strong>5.80</strong></td>
<td><strong>5.82</strong></td>
<td><strong>6.51</strong></td>
<td><strong>6.62</strong></td>
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</table>

Full time equivalent postsecondary teachers whose principal activities are for instruction, research, and/or public service. They may hold academic rank titles of professor, associate professor, assistant professor, instructor, lecturer or equivalent of any of those academic ranks.
transcending the traditional

school of biological and health systems engineering

1,066 students
881 undergraduate
185 graduate

biomedical engineering
biological design

school of computing, informatics, and decision systems engineering

4,151 students
2,904 undergraduate
1,247 graduate

computer engineering
computer science
computer systems engineering
engineering management
industrial engineering
informatics
software engineering

school of electrical, computer and energy engineering

2,490 students
2,382 undergraduate
1,106 graduate

electrical engineering
computer engineering

school for engineering of matter, transport and energy

3,520 students
2,778 undergraduate
742 graduate

aerospace engineering
chemical engineering
materials science and engineering
mechanical engineering
solar energy engineering and commercialization

civil, environmental and sustainable engineering
construction engineering
civil engineering
construction management

school of sustainable engineering and the built environment

1,414 students
1,068 undergraduate
346 graduate

aviation
human systems engineering
engineering (integrated concentrations)
manufacturing engineering
environmental and resource management
graphic information technology
information technology
technological entrepreneurship and management

the polytechnic school

3,277 students
3,030 undergraduate
247 graduate

transdisciplinary partners

THE BIODISEIGN INSTITUTE
GLOBAL INSTITUTE OF SUSTAINABILITY
SECURITY AND DEFENSE SYSTEMS INITIATIVE

Current academic programs and schools structure
(6 schools, 2 campuses, 20+ degree programs)
Exemplar University Partnerships

• **US Army Flexible Electronics and Display Center**  
  (10 years/$94M and 40+ industry partners)

• **NSF/DOE QESST Photovoltaic Engineering Research Center**  
  (ASU lead + MIT, Cal Tech, GA Tech, UH, UNM, UA and 30+ industry partners)

• **NSF FREEDM Engineering Research Center**  
  (NC State lead + ASU, MUST, FSU and 30+ industry partners)

• **NSF Engineering Research Center – Center for Bio-mediated and Bio-inspired Geotechnics**  
  (ASU lead + GA Tech, NMS, UC-Davis and 12+ industrial partners)

• **5 NSF Industry-University Collaborative Research Centers**  
  (IUCRC’s, 4 with ASU leads, more than GA Tech, Michigan, UC Berkeley, and 50+ industrial partners)

• **Higher Engineering Education Alliance Program**  
  (HEEAP + USAID, Intel, Siemens, National Instruments and other industry partners)
ASU Teaching and Learning Realms for Wave 5

Full Immersion
On-campus Technology Enhanced

The ideas and means of the university

01
Knowledge

02
Digital Immersion Online Technology Enhanced

03
Digital Immersion Massively Open Technology Enhanced

04
Education through Exploration Technology Enhanced

TBD
Waves 1-4

The university faculty is at the core of all models.
Wave 5

Adaptive knowledge creation is at the core of the university and is essential.
Advancing Learning and Knowledge
Core Enterprise Structure

EOSS

Academic Affairs and Student Success Cluster

EdPlus

Business Affairs Cluster

Colleges & Schools

Faculty

Knowledge

Students

Staff

Institutes & Initiatives

University Affairs Cluster

Knowledge Enterprise Cluster

ASU Enterprise Partnerships

ASUF
Teaching/Learning Realm 1

Full Immersion / On-campus / Technology Enhanced

Goals:
- Broad admission standards
- Fluid interface with community colleges
- Socioeconomic status predicts nothing
- All students are science and technology literate
- 2-3 majors are common
- Costs are lowered for all
- Scalable to 3x the historic norm
Teaching/Learning Realm 2

Digital Immersion / On-line / Technology Enhanced

Goals:

- College completion for the majority
- Lifelong personalized learning
- Lifelong network learning
Teaching/Learning Realm 3

Digital Immersion / Massive Scale / Technology Enhanced

Goals:
- Enhance social scale learning
- Enhance learning activation
- Enhance college pipeline
- Move at social speed
Teaching/Learning Realm 4

Education through ETX / Technology Enhanced

Goals:
- Global scale engagement
- Totally personalized learning
Five Forces Are Reshaping Higher Education

1. Economic and social disruption is continuing to accelerate, which is placing many institutions at risk.
2. The globalization of education is accelerating.
3. New business and delivery models are gaining traction.
4. Greater transparency about student outcomes is becoming the norm.
5. Student and family demands are rising for a greater return on investment in higher education.
The Wave 5 Emergent

North Star Trajectory

Phase 1  Current Projects
(e.g. University Innovation Alliance)

Phase 2  Refinement of an Executable
(and Repeatable) Strategy

Phase 3  Execution (including financing,
technology platforms, staffing,
organizational framework, and
outcome measurement)