



Research, Development & Education (R+D+E): Management and Innovation Required for the XXI Century

University of South Florida,
Tampa - Florida
October 10 - 14, 2016





Welcoming to USF

By

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\$488.6 Million

A TOP 25 PUBLIC RESEARCH UNIVERSITY

USF SYSTEM FACTS 2016-2017







USF UNIVERSITY OF
SOUTH FLORIDA





USF SYSTEM ENROLLMENT

Enrollment Data as of Drop/Add Fall 2016





	USF System		USF Tampa		USF St. Petersburg		USF Sarasota-Manatee	
Undergraduate	36,463	73.5%	30,619	71.5%	4,043	85.7%	1,801	87.0%
male	16,240	44.5%	14,036	45.8%	1,500	37.1%	704	39.1%
female	20,218	55.4%	16,578	54.1%	2,543	62.9%	1,097	60.9%
not reported	5	-	5	-	-	-	-	-
full-time	27,389	75.1%	23,641	77.2%	2,740	67.8%	1,008	56.0%
part-time	9,074	24.9%	6,978	22.8%	1,303	32.2%	793	44.0%
Graduate	10,239	20.6%	9,504	22.2%	553	11.7%	182	8.8%
male	4,260	41.6%	4,008	42.2%	181	32.7%	71	39.0%
female	5,967	58.3%	5,484	57.7%	372	67.3%	111	61.0%
not reported	12	0.1%	12	0.1%	-	-	-	-
full-time	5,640	55.1%	5,443	57.3%	136	24.6%	61	33.5%
part-time	4,599	44.9%	4,061	42.7%	417	75.4%	121	66.5%
Doctor of Medicine	704	1.4%	704	1.6%	-	-	-	-
male	390	55.4%	390	55.4%	-	-	-	-
female	301	42.8%	301	42.8%	-	-	-	-
not reported	13	1.8%	13	1.8%	-	-	-	-
full-time	704	100%	2	0.3%	-	-	-	-
part-time	0	-	702	99.7%	-	-	-	-
Non-Degree seeking	2,185	4.4%	1,976	4.6%	121	2.6%	88	4.2%
male	1,089	49.8%	996	50.4%	56	46.3%	37	42.0%
female	1,092	50.0%	978	49.5%	65	53.7%	49	55.7%
not reported	4	0.2%	2	0.1%	-	-	2	2.3%
full-time	913	41.8%	891	45.1%	5	4.1%	17	19.3%
part-time	1,272	58.2%	1,085	54.9%	116	95.9%	71	80.7%
TOTAL	49,591	-	42,803	-	4,717	-	2,071	-
male	21,979	44.3%	19,430	45.4%	1,737	36.8%	812	39.2%
female	27,578	55.6%	23,341	54.5%	2,980	63.2%	1,257	60.7%
not reported	34	0.1%	32	0.1%	-	-	2	0.1%
full-time	33,944	68.4%	29,977	70.0%	2,881	61.1%	1,086	52.4%
part-time	15,647	31.6%	12,826	30.0%	1,836	38.9%	985	47.6%

FIRST TIME IN COLLEGE (FTIC) ENROLLMENT



Enrollment Data as of Drop/Add Fall 2016

10

NEW STUDENT PROFILE

(FTIC)

	USF System	USF Tampa	USF St. Petersburg	USF Sarasota-Manatee
number of new FTICs	2,948	2,465	396	87
average high school GPA	4.05	4.08	3.86	3.9
average SAT	1213	1226	1142	1133
mid-range SAT	1140-1280	1160-1290	1060-1220	1060-1190
average ACT	28	28	26	25
mid-range ACT	26-30	26-30	24-28	22-26
top 10% of high school class	31%	34%	18%	20%
Florida residents receiving Bright Futures scholarship	67%	-	-	-
non-White	40%	41%	35%	22%
reside in on-campus housing (fall)	1,967 (66.7%)	1719 (69.7%)	248 (62.6%)	n/a
National Merit Scholars	15	15	-	-
National Hispanic Scholars	4	3	1	-
Florida residents	2,584	2,142	361	81
out-of-state students	364	323	35	6
Florida counties represented	48	45	34	8
states represented	37	37	12	2
countries represented	68	64	10	5
Florida high schools represented	424	396	184	31



USF SYSTEM ACADEMICS

- USF Tampa ranks among the top tier of colleges listed in the *U.S. News and World Report Best Colleges 2016*, ranking in the top 100 of best public national universities.
- According to the *Academic Ranking of World Universities (ARWU) (2015)*, USF Tampa ranks among the top 300 of the best colleges and universities in the world.
- USF Tampa graduate level programs continue to be ranked among the best according to the 2017 *U.S. News and World Report Graduate School Rankings*. USF graduate programs in the top 50 include: Industrial and Organizational Psychology (#4), Public Health (#16), Audiology (#17), Criminology (#22), Library and Information Studies (#24), Rehabilitation Counseling (#24), Nursing (#40), Industrial/Manufacturing Engineering (#46), and Clinical Psychology (#50).
- USF Tampa is ranked among the best in 2016 *U.S. News and World Report's Online Education Program* rankings. USF graduate programs ranked in the top 50 include: Information Technology (#14), Engineering (#20), Business (non-MBA) (#22), and Education (#36).
- USF Tampa was named one of the Top 100 Best Values in Public Colleges (#45) by *Kiplinger's Personal Finance* for 2016.
- USF Tampa ranks in the top 50 among U.S. public institutions in the *Times Higher Education World* university rankings (2016).
- USF St. Petersburg's undergraduate programs were ranked in the top 25 (#23) for all Public Southern Regional Universities by *U.S. News and World Report* (2016).

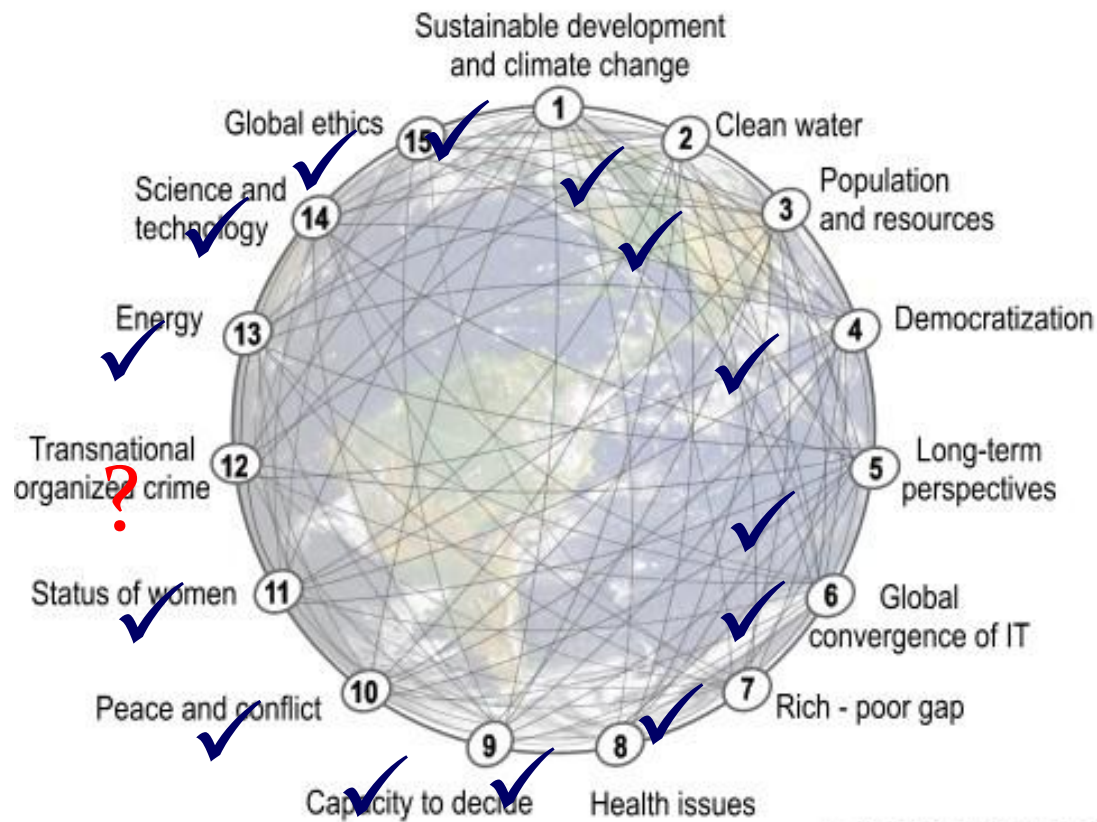
Presentation Objectives

- To **share knowledge** from Engineering Disciplines and tools designed to help us solve Complex Trans/Multi/Inter-disciplinary engineering challenges
- To **share** on-going efforts in **I+D+E** at the College of Engineering/Department of Electrical Engineering at USF
- To Emphasize the Importance of Creating Vehicles of Interaction Between Academia, Industry, Funding Agencies and Government and the impact of the ISTEAC network

“Student Success is Everyone’s Responsibility....”

The Millennium Project

15 Global Challenges facing humanity



by The Millennium Project
www.millennium-project.org

Engineering Grand Challenges



Make solar energy economical



Provide energy from fusion



Develop carbon sequestration methods



Manage the nitrogen cycle



Provide access to clean water



Restore and improve urban infrastructure



Advance health informatics



Engineer better medicines



Reverse-engineer the brain



Prevent nuclear terror



Secure cyberspace



Enhance virtual reality



Advance personalized learning



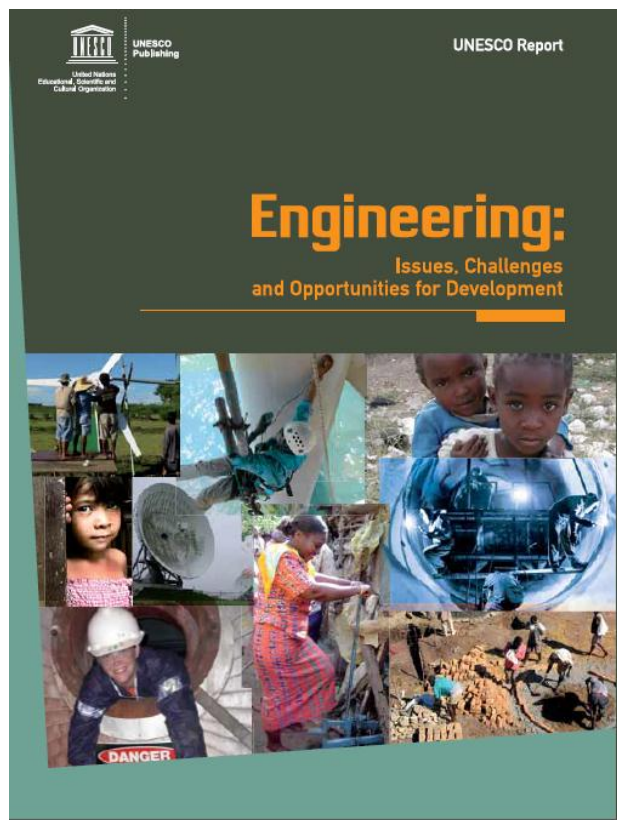
Engineer the tools of scientific discovery

Source:



NATIONAL ACADEMY OF ENGINEERING
OF THE NATIONAL ACADEMIES

<http://www.engineeringchallenges.org>



Knowledge-enabled economies are able to constantly modernize their education systems in line with changes in:

Societal needs
&
Economic policies.



Retos de la Investigación en la Región

- De manera creciente la sociedad reclama de la C&T aportes verificables que respondan a necesidades apremiantes de la sociedad
 - ✓ Hambre
 - ✓ Desnutrición
 - ✓ Pobreza extrema
 - ✓ Desempleo
 - ✓ Violencia y (PAZ)
 - ✓ Deterioro ambiental
- Los grandes desafíos sociales, económicos y ambientales del país, son un reto para la comunidad científica y tecnológica.

Identifying the Strategies Needed to Ensure the Continued Leadership of Research Universities

The following factors have placed great strains on American research universities.

- Declining funding
- Increasing competition from academic institutions worldwide,
- Intensifying compliance requirements from the federal government
- Loss of political and public confidence in the value of academic research

<https://www.elsevier.com/connect/studytackleschallengesofusresearchuniversities>



11/12/2015

Study tackles challenges of US research universities

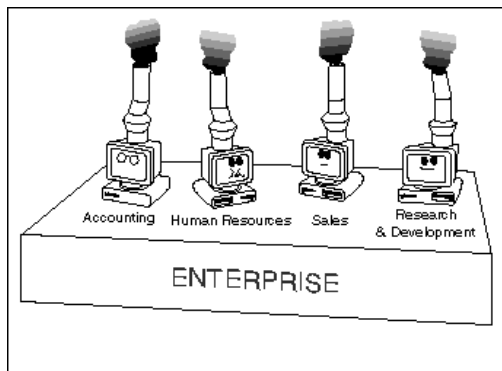
 [elsevier.com](http://www.elsevier.com)

<https://www.elsevier.com/connect/study-tackles-challenges-of-us-research-universities>

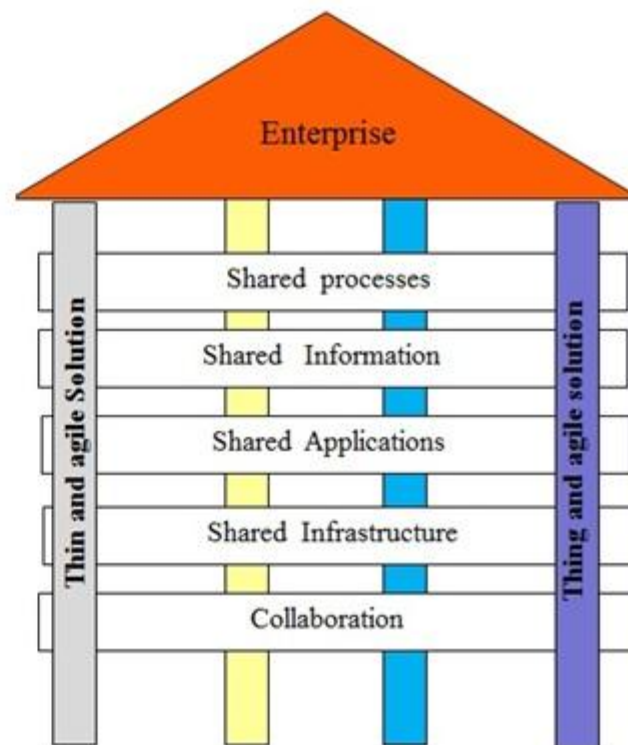
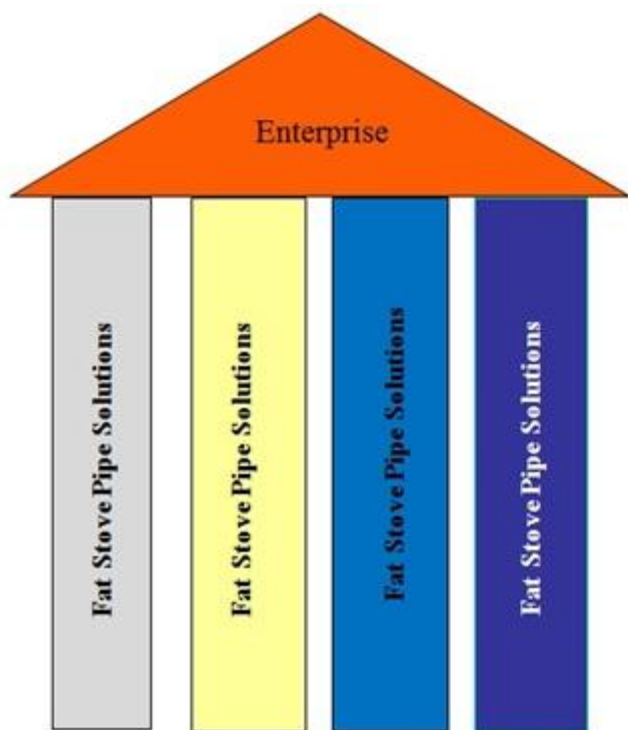
Study tackles challenges of US research universities

Facing increasing pressures and declining funding, institutions seek solutions for sustainability



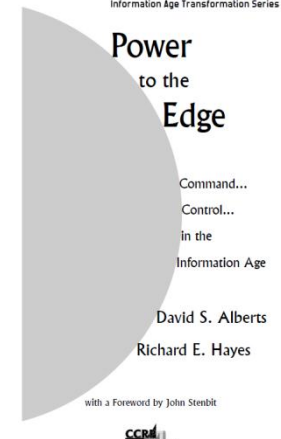
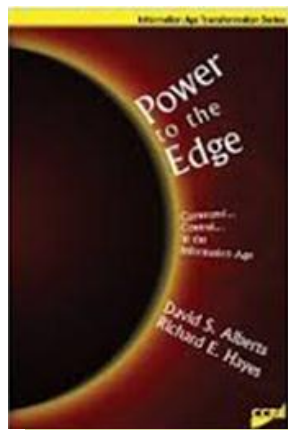


Stovepipe Organization

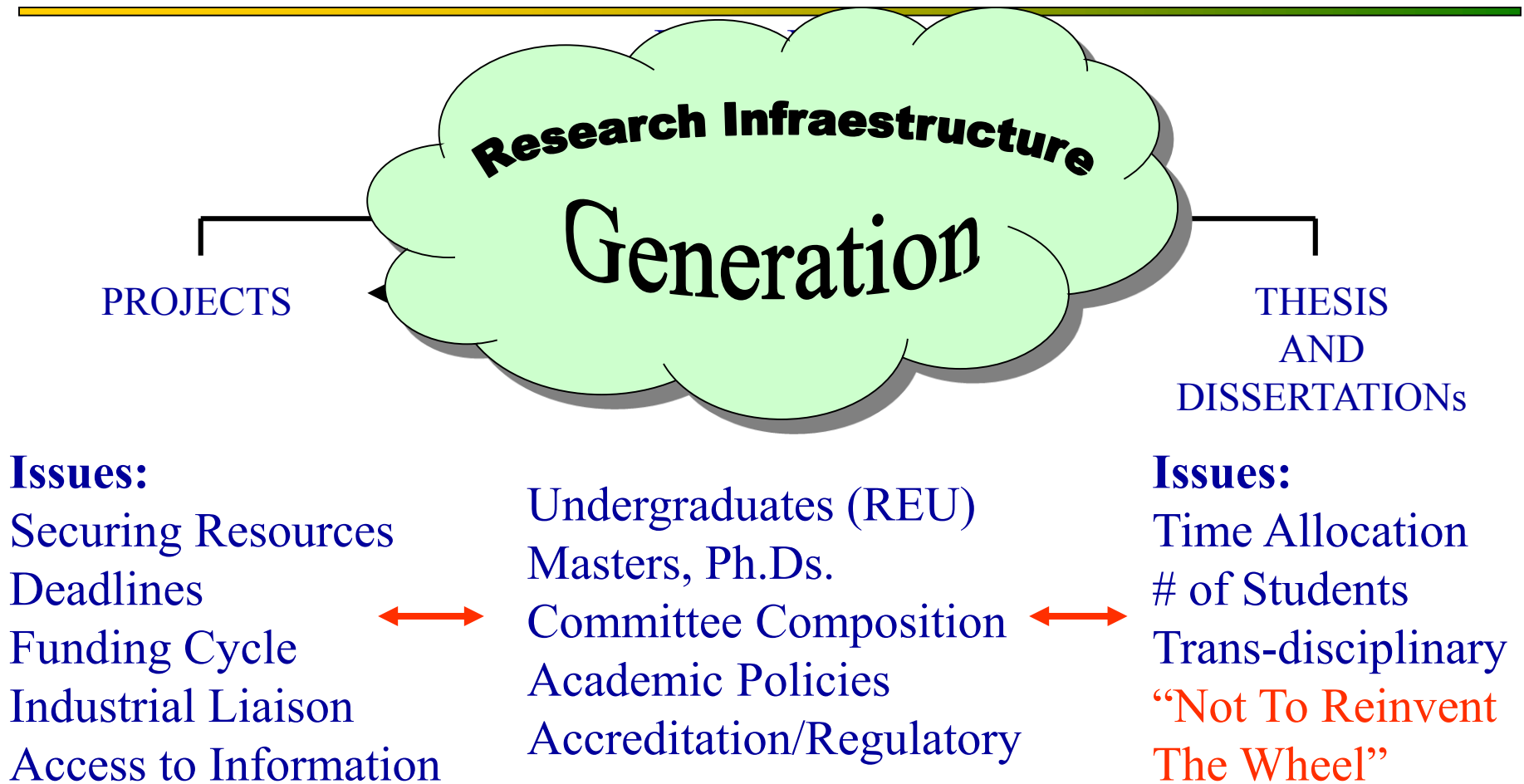


Power to the Edge

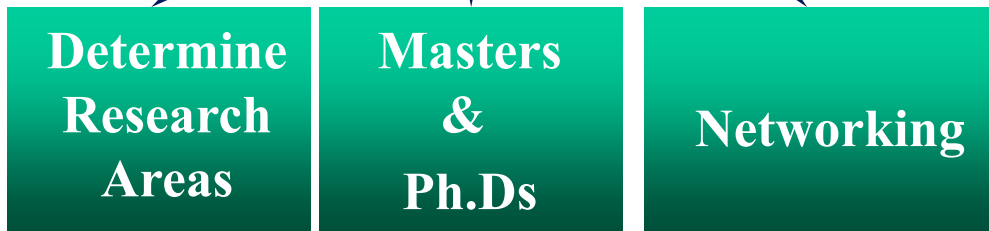
“Power to the Edge involves the empowerment of individuals at the edge of an organization - where the organization interacts with its operating environment to have an impact or effect on that environment”



Research Challenges



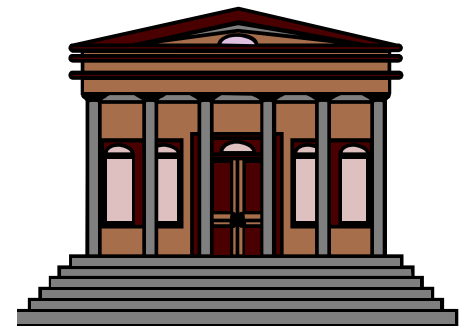
Research Centers/Groups



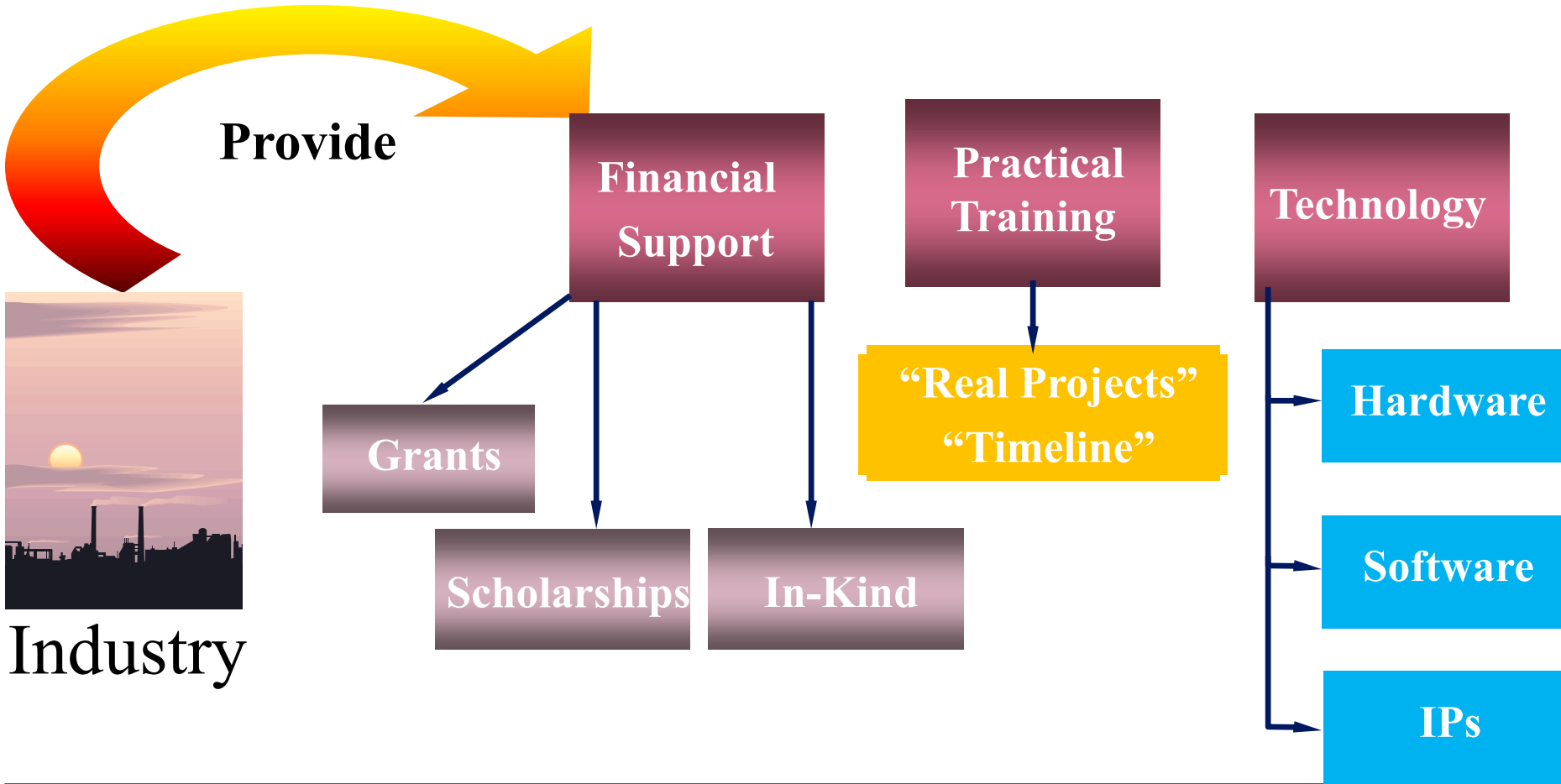
**R&D with Societal Impact
“Economic Development”**

**Responsibility to Share Knowledge by
Publishing in National and International
Journals & Conferences**

Form “Integral” Researchers



University



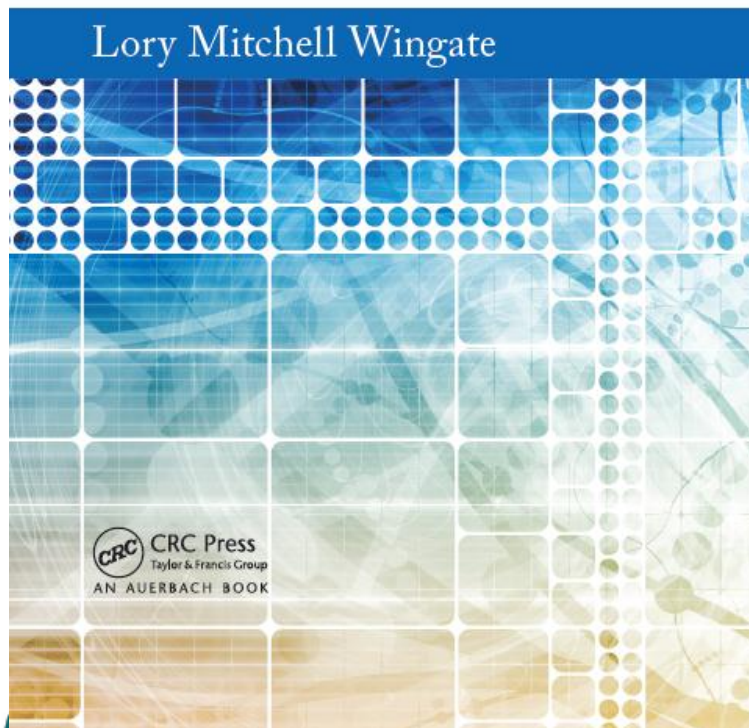


Best Practices and Advances in Program Management

Project Management for Research and Development

Guiding Innovation for Positive R&D Outcomes

Lory Mitchell Wingate



2015 CRC 9781420066596 65-9630-6

Inter-American Science & Technology Education Consortium

The Systems Engineering Role in Research & Development – (R&D&E&I)

- Can be the foundation upon which R&D success can be achieved
- R&D activities have an inherent ambiguity, a need for creative exploration, and often lack defined scope, milestones and outcomes.
- System of Systems (SoS) engineering processes also provide the insight necessary to make informed decisions about R&D progress along a trajectory, to take definitive action to stop or change course, and to document and use the results of experiments and testing to make timely course corrections

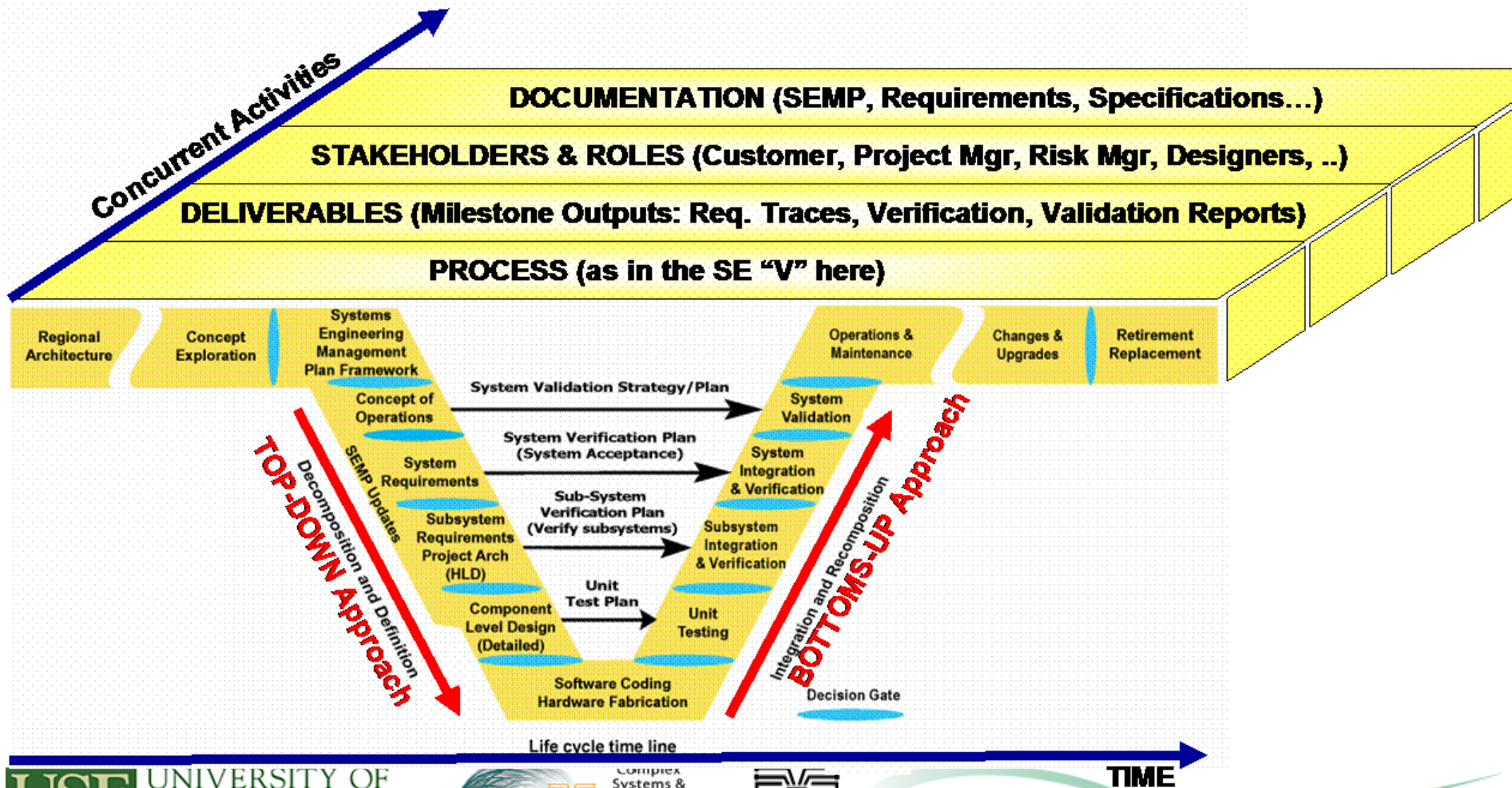


The International Council on Systems Engineering (INCOSE)

- Systems Engineering as a discipline:
 - ✓ It provides structure and methods to define and organize projects
 - ✓ To integrate activities and ensure that interfaces are correctly identified and addressed
 - ✓ To ensures testing of components and systems are completed
 - ✓ Manages risks and reviews
 - ✓ Performs configuration management to ensure that design changes are tracked and implemented methodically so that the current configuration is always known.

The System Engineering “VEE”

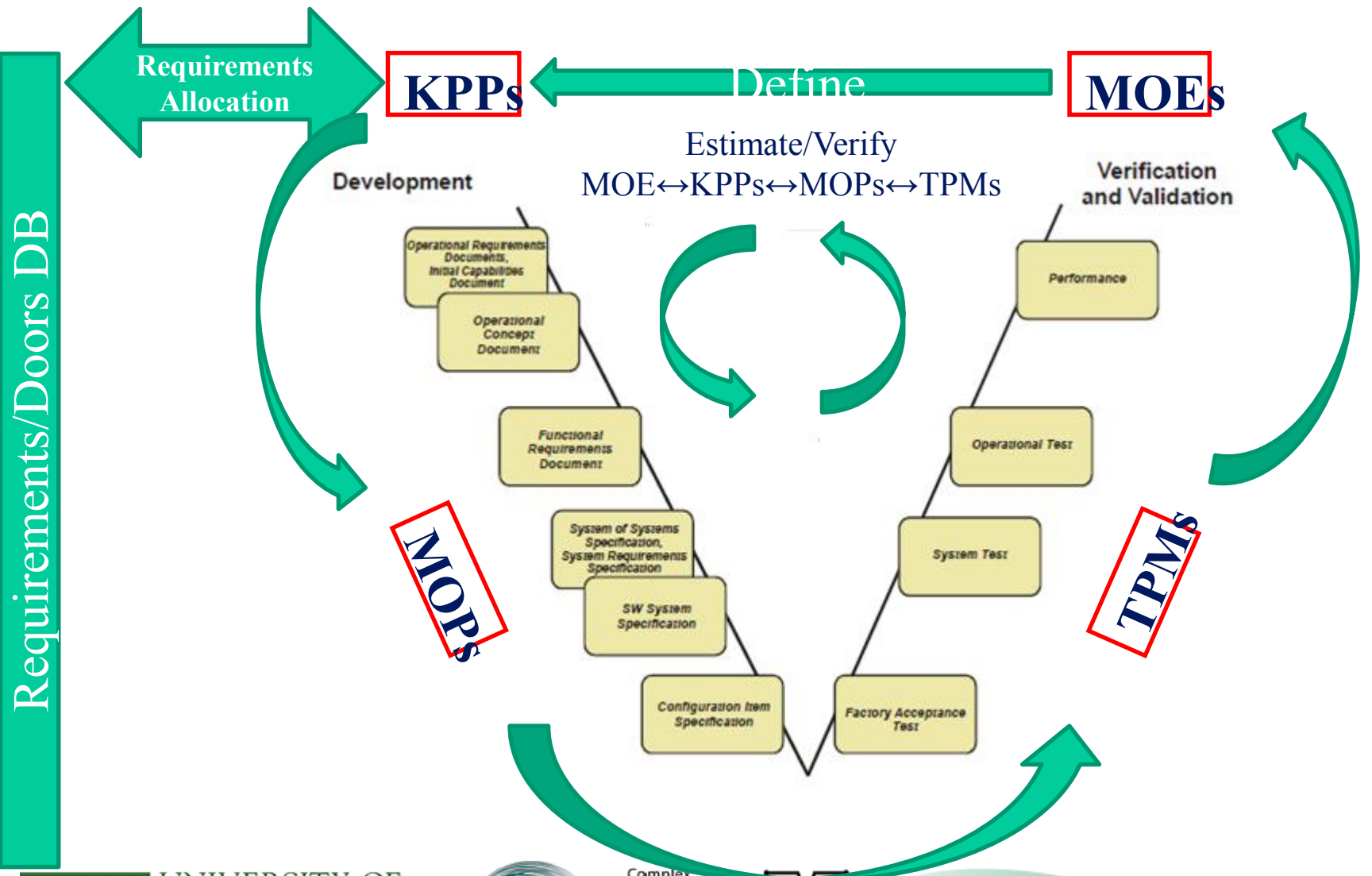
Today, the VEE Development Model is part of systems engineering standards including EIA 632 and ISO 15288. It has become popular in a number of industries including automotive, banking, defense, and aerospace.



Theory of Change Basics



1. Identifying long-term goals and the assumptions behind them Backwards mapping from the long-term goal by working out the preconditions or requirements necessary to achieve that goal--and explaining why.
2. Voicing your assumptions about what exists in the system without which your theory won't work, and articulating your rationales for why outcomes are necessary preconditions to other outcomes.
3. Weighing and choosing the most strategic interventions to bring about your desired change.
4. Developing indicators to measure progress on your desired outcomes and assess the performance of your initiative.
5. Quality review should answer three basic questions: Is your theory 1) reasonable, 2) "doable" (or feasible), and 3) testable?
6. Writing a narrative to explain the summary logic of your initiative

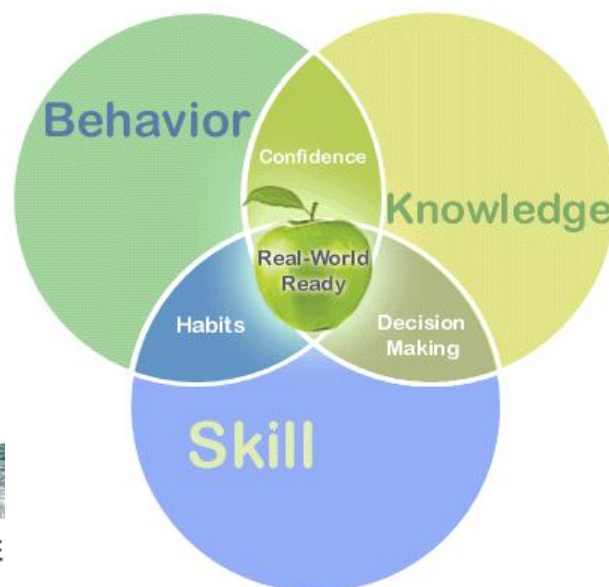


Driving Innovation with Project Management

- Innovation is inclusive of process, research, application, design, and many other activities, where R&D is typically identified with basic and applied research and product development.

The application of project management methodology can effectively enhance the performance of innovation projects

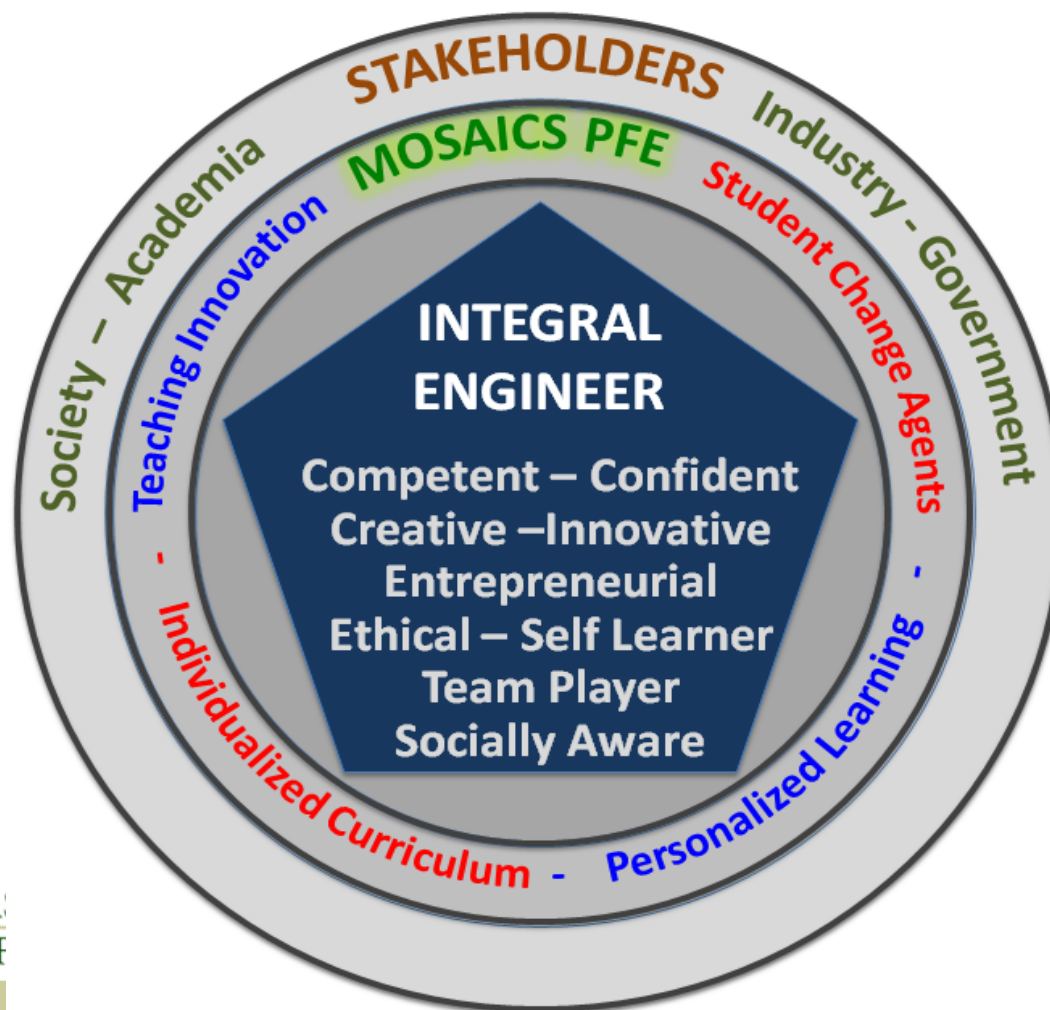
How to prepare *engineer students, faculty, researchers* and *university administrators* to face such challenges?



Electrical Engineering Modernization and Social Adaptation Using a Complex Systems Approach (*EE MOSAICS*)

- Establish levels (statements, numbers, %, etc) of desired outcomes in order of relative importance.
- Define the assessment methods to provide evidence of desired outcomes.
- Identify the changes required in order to achieve the desired outcomes:
 - In curriculum
 - In teaching methods
 - In learning environment
 - In faculty
 - In procedures
 - In policies
 -
- Research existing knowledge of change theory to select most appropriate change strategy and perspective. Involve all action agents (students, faculty, stake holders). Strive for a shared vision, reflective teachers and complexity leadership.

Electrical Engineering Modernization and Social Adaptation Using a Complex Systems Approach (**EE MOSAICS**)



The Florida Consortium of Metropolitan Research Universities is a joint effort of Florida International University, The University of Central Florida, and The University of South Florida

- ✓ Faculty Learning Communities (FLCs) in Chemistry, Biology, Mathematics, Physics, and Engineering.
- ✓ FLCs will be charged to:
 1. analyze data on student retention and graduation in their respective disciplines
 2. investigate innovative programs and policies that may contribute to higher completion rates and student learning



Personalized Learning EcoSystem (PLES) @ USF:

**“From Control Systems Theory/Solutions to System Deployment:
Empowering Faculty & Students to Discover & Learn”**

**A Collaborative Proposal
NI – CoE/EE@USF – Quanser**

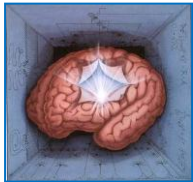
Evidence-Based Approach



“Throughout the educational system, teaching has traditionally followed a one-size-fits-all approach to learning, with a single set of instructions provided identically to everybody in a given class, regardless of differences in aptitude or interest. Similar inflexibility has persisted in adult education programs that ignore differences in age, cultural background, occupation, and level of motivation” [1]



“To seriously consider implementing long term and conceptually deep changes in the science and mathematics curricula is an exciting prospect. Properly infused into the curriculum, the cross-disciplinary concepts and methodologies emerging from complex systems research have the potential to form the basis of a new and principled scientific literacy for our student to learn, one that is powerful and appropriate for dealing with the problems and demands of the 21 century” [2]

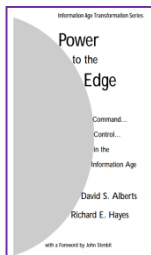


“Ongoing research in neuroscience is providing new insights into the intricacies of neural processes underlying learning, offering clues to further refine individualized instruction. Given the diversity of individual preferences, and the complexity of each human brain, developing teaching methods that optimize learning is a major challenge for the software engineers & educators of the future...” [1]



"Pedagogy" literally means "leading children.", "Andragogy" was a term coined to refer to the art/science of teaching adults. The four andragogical assumptions are that adults:

- 1) move from dependency to self-directedness;
- 2) draw upon their reservoir of experience for learning;
- 3) are ready to learn when they assume new roles; and
- 4) want to solve problems and apply new knowledge immediately. [3]



"Power to the Edge" is an information and organization management philosophy first articulated by the U.S. Department of Defense that refers to the ability of an organization to dynamically synchronize its actions and achieve agility. The term is most commonly used in relation to military organizations, but it can equally be used in a civilian context, i.e Education – By Empowering the “people” at the “Edge” that are carrying out the mission of the organization, i.e. “Faculty/Students....”[4]

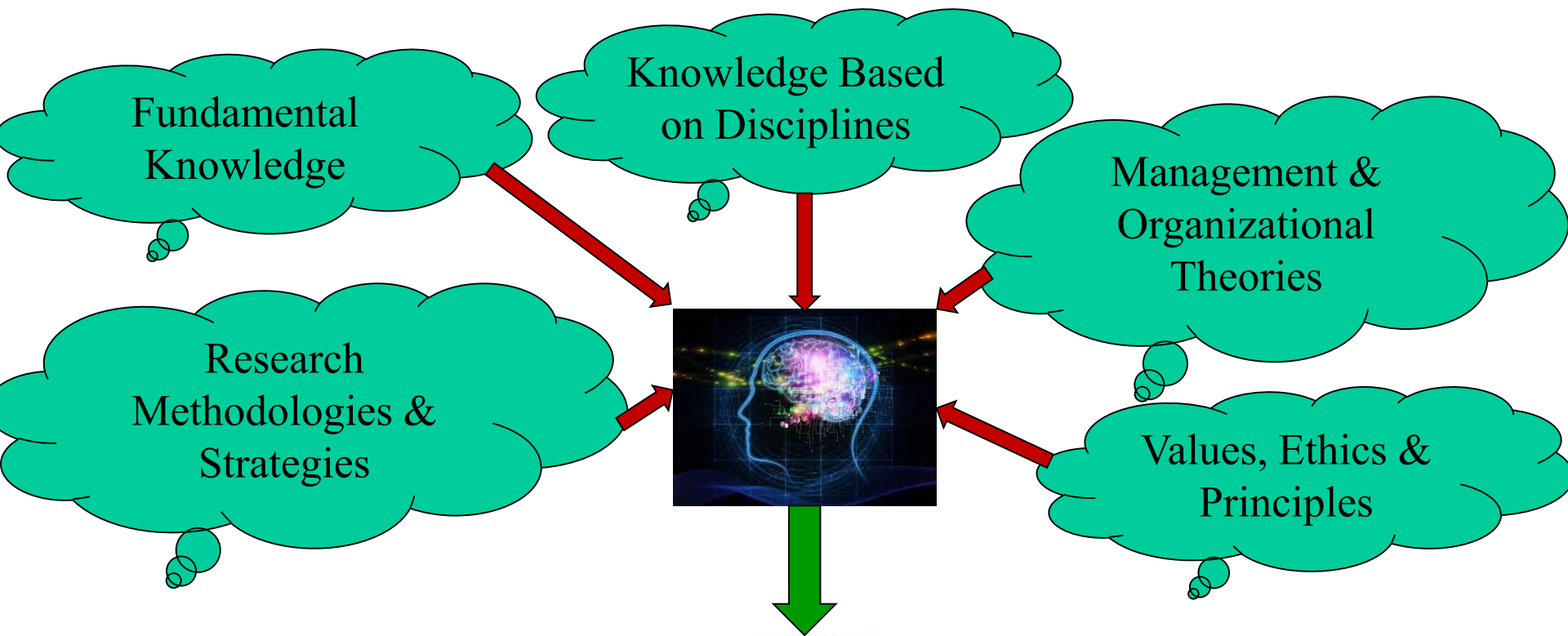
¹ <http://www.challenges.org/cms/8996/9127.aspx>

² Complex Systems and Education: Cognitive, Learning, and Pedagogical Perspectives by Michael Jacobson & Working Group 2 Collaborators

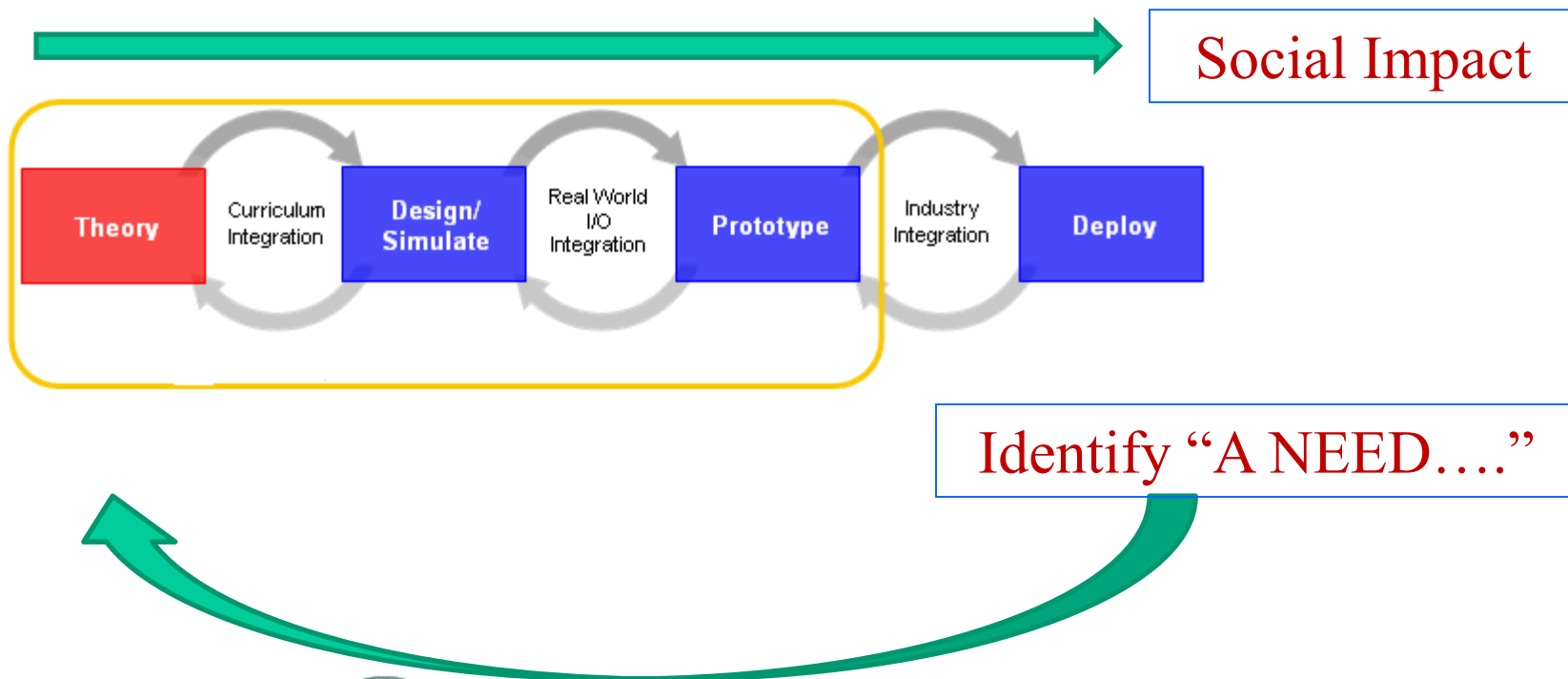
³ <http://www.educatorstechnology.com/2013/05/awesome-chart-on-pedagogy-vs-andragogy.html>

⁴ http://www.dodccrp.org/files/Alberts_Power.pdf

R+D+E from a Complex Systems Perspective

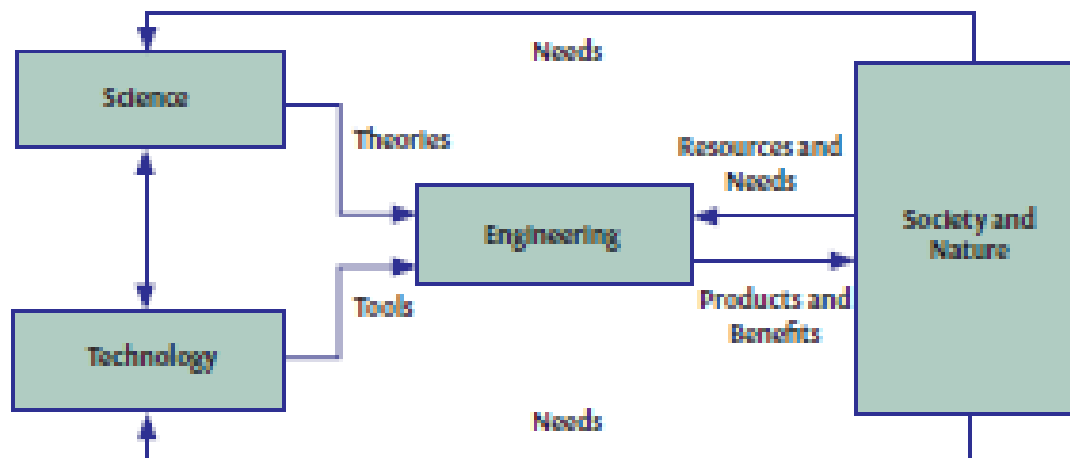


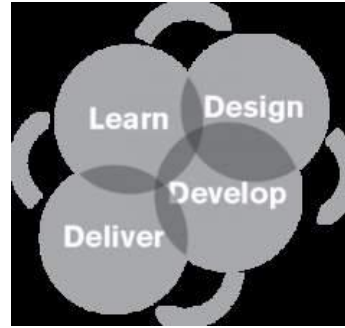
“Innovation Opportunity via Social Responsibility”



“AN INTEGRAL”: Engineer/Researcher/Educator

- Create technologies and infrastructure to address human, social and economic issues, and challenges
- Connect social needs with innovation and commercial applications – “Economic Development”.
- To form the engineer prepared to face the challenges of the 21st century





THE LEAN STARTUP PROCESS - DIAGRAM

- ✓ Too many startups (**engineers**) begin with an idea for a product that they think people want.
- ✓ They then spend months, sometimes years, perfecting that product without ever showing the product to the prospective customer.
- ✓ When they fail, it is often because they never spoke to prospective customers and determined whether or not the product was interesting.

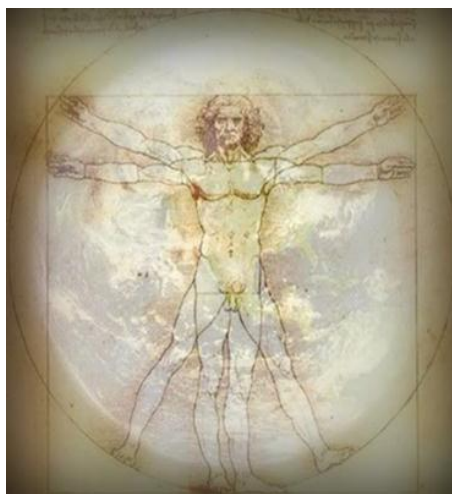


<http://theleanstartup.com/>



Education

Research



Innovation

Development



United Nation's definition of Sustainable Development

El desarrollo sustentable es el desarrollo que satisface las necesidades del presente sin comprometer la capacidad de las generaciones futuras para satisfacer sus propias necesidades

A PRIMER ON: SUSTAINABLE TECHNOLOGY AND DEVELOPMENT

CAROL CARMICHAEL

INSTITUTE FOR SUSTAINABLE TECHNOLOGY AND DEVELOPMENT

GEORGIA INSTITUTE OF TECHNOLOGY

The Millennium Project

“Son tiempos de grandes oportunidades y optimismo puesto que la aplicación de las nuevas tecnologías emergentes no sólo tienen la capacidad de mejorar la calidad de vida, pero también permiten la creación y el florecimiento de nuevas comunidades y instituciones sociales mejor preparadas **para afrontar las necesidades de nuestra sociedad**”



Innovación

“En realidad la mayoría de innovaciones son creadas a través de REDES – grupos de personas trabajando en “concordancia”

Dr. Andrew B. Hargadon
Professor of Management

Director, Technology Management Programs
Faculty Director, UC Davis Center for Entrepreneurship



Muchas Gracias



wmoreno@usf.edu

www.usf.edu



Ibero-American Science & Technology Education Consortium