Use of Sustainable Nanotechnology Examples in the College Classroom

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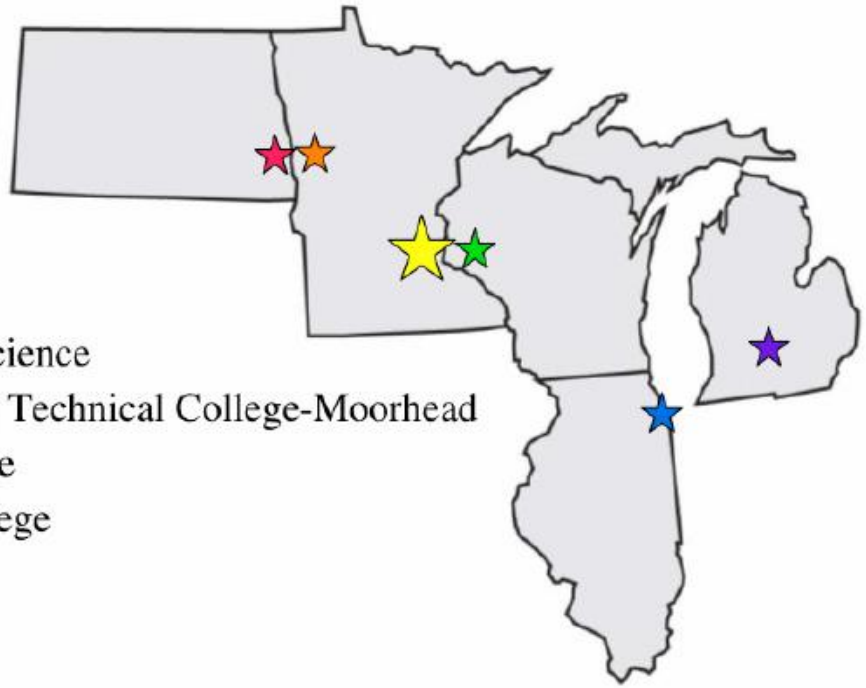
Nano-Link

Midwest Regional Center for Nanotechnology Education



- North Dakota State College of Science
- Minnesota State Community and Technical College-Moorhead
- Dakota County Technical College
- Chippewa Valley Technical College
- William Rainey Harper College
- Lansing Community College

Lead Institution: Dakota County Technical College
University Partner: University of Minnesota
PI: Deb Newberry deb.newberry@dctc.edu

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Nano Infusion Project

- Complete, topical modules to high school and college educators
- Module = Activities, background, worksheets, ppt, video, resources etc.
- Currently 12 modules (8 additional this year)
- Educator Workshops
- This school year
- Over 5000 students
- 92 Teachers
- 17 States

The Approach

Idea for a nanoscience 2 year program (2003)

Industry input	U of MN partnership

NSF ATE Project Grant (2004 – 2008)

2 yr, multi-disciplinary program	43 of the 72 credits = nano specific courses

Regional Center for Nanotechnology Education: Nano-Link (2008 – 2012)

Share program, courses	Modular approach developed for nano content

Nano- Link II – partner with other NSF Centers (2012 – 2015)

Nano content into industry specific modules

Biotechnology, photonics, material science

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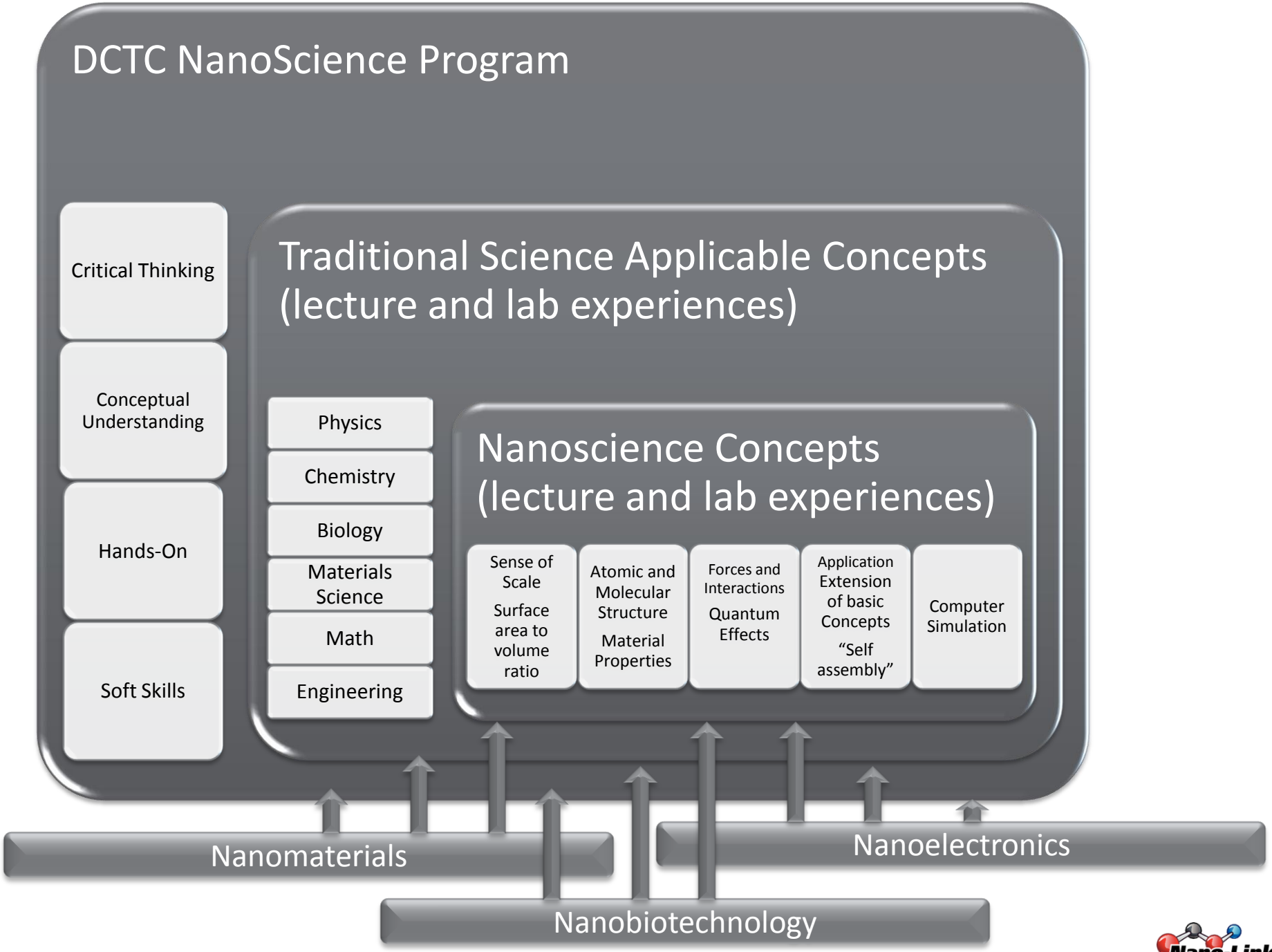
DCTC NanoScience Program
Critical Thinking
Conceptual Understanding
Hands-On
Soft Skills
Traditional Science Applicable Concepts (lecture and lab experiences)
Physics
Chemistry
Biology
Materials Science
Math
Engineering
Nanoscience Concepts (lecture and lab experiences)
Sense of Scale
Surface area to volume ratio
Atomic and Molecular Structure
Material Properties
Forces and Interactions
Quantum Effects
Application Extension of basic Concepts
"Self assembly"
Computer Simulation
Nanomaterials
Nanoelectronics
Nanobiotechnology

Dakota County Technical College
Nanoscience Technology Program Course Outline and Credit Allocation

rev. 2011

Semester 1 at DCTC			Semester 2 at DCTC			Semester 3 at DCTC			Semester 4 At Univ. of MN		
Course	Name	Credits	Course	Name	Credits	Course	Name	Credits	Course	Name	Credits
BIOL 1500	General Biology	4	CHEM 1500	Introduction to Chemistry	4	NANO 2101	Nano Electronics	3	MT 3111	Elem. of Micro Manufacturing	3
PHYS 1100	College Physics I	4	PHYS 1200	College Physics II	4	NANO 2111	Nanobiotechnology/ Agriculture	3	MT 3112	Elem. of Micro Mfg Lab	1
ENGL 1100	Writing & Research Skills	3	SPEE 1020	Interpersonal Communication	3	NANO 2121	Nanomaterials	3	MT 3121	Thin Films Deposition	3
MATS 1300	College Algebra	4	MATS 1250	Principles of Statistical Analysis	4	NANO 2131	Manufacturing, Quality Assurance	2	MT 3131	Intro to Materials Characterization	3
NANO 1100	Fund. of Nano I	3	NANO 1200	Fund of Nano II	3	NANO 2140	Interdisciplinary Lab	3	MT 3132	Materials Characterization Lab	1
			NANO 1210	Computer Simulation	1	NANO 2151	Career Planning and Industry	1	MT 3141	Principles and Applications of Bionanotechnology	3
			NANO 1222	Student Lab Experience and Research	3				MT 3142	Nanoparticles & Biotechnology Lab	1
									NANO 2970	Internship	2
Credits		18	Credits		19	Credits		15	Credits		17

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Approaches
Top down
Bottom Up

Technology Maturity Model
Descriptor
Participants
Funding
Non-technical influences

Societal Aspects
Global
EPA, FDA, Regulatory
Multi-Disciplinary
Intellectual Property

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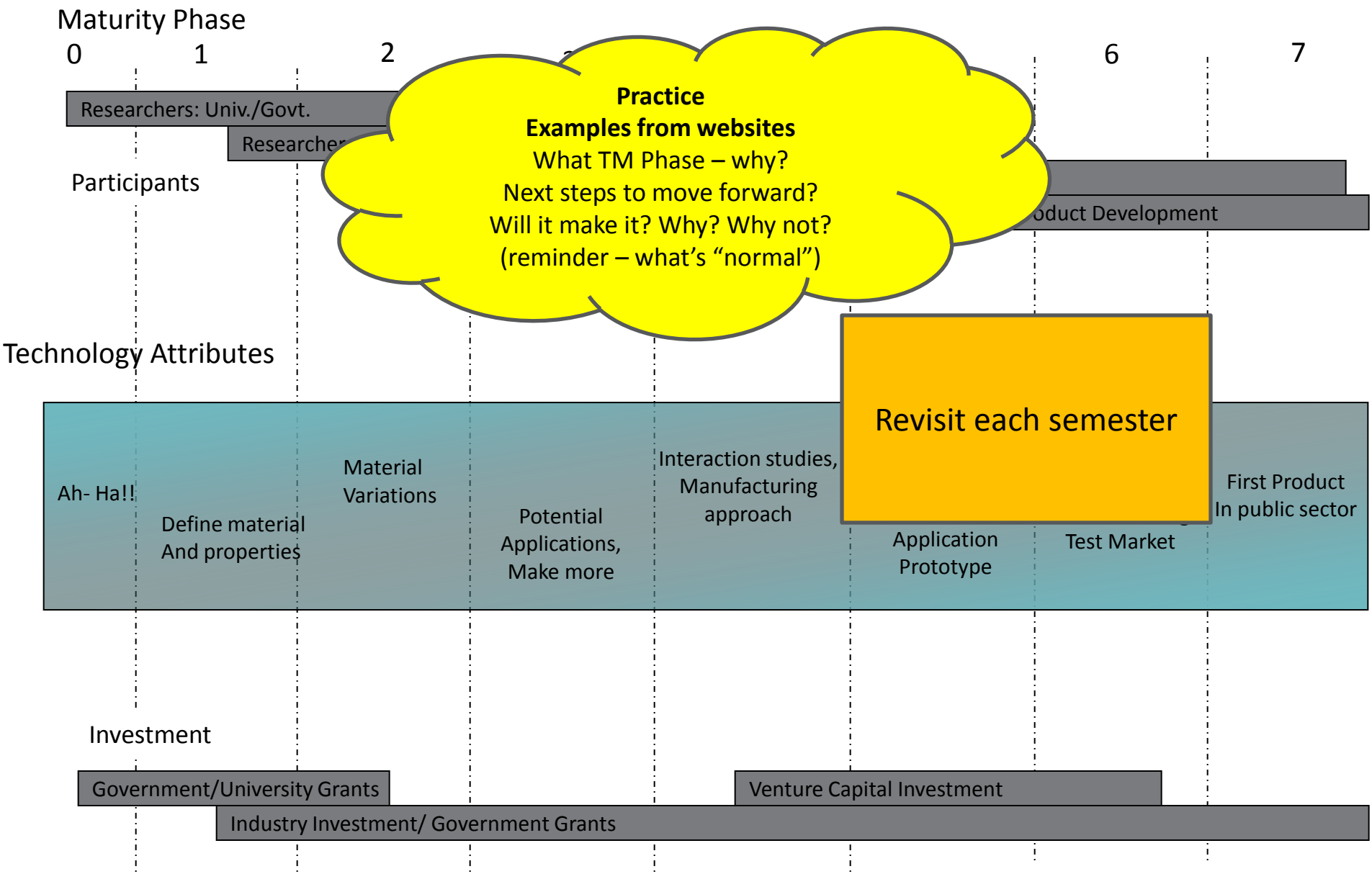

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Complex Systems
P,C,B, MS

Manf., QA
Select Application
FMECA
Reliability
EHS

EHS
Starting material
Use, operation
End of life

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Applications
Agricultural Sensors
Environ. sensing/ purification
Energy (Solar, cellulose, biofuels, mechanical, thermal etc.)

Functionalized Gold NPs
Tumor destruction
Exit Body
Capture/Contain/Reuse

Industry Activities
Technical
Environmental
Non-Technical

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Summary

- Multi-disciplinary 72 credit NanoScience Program
- Concepts, hands-on, analytical and 21st Century skills
- Sustainable nanotechnology concepts, activities, experiments included in all semesters
- Student research includes feasibility studies, industry research support – partnerships with Univ. in research (NP impact on diatoms)

Thank you!!!!

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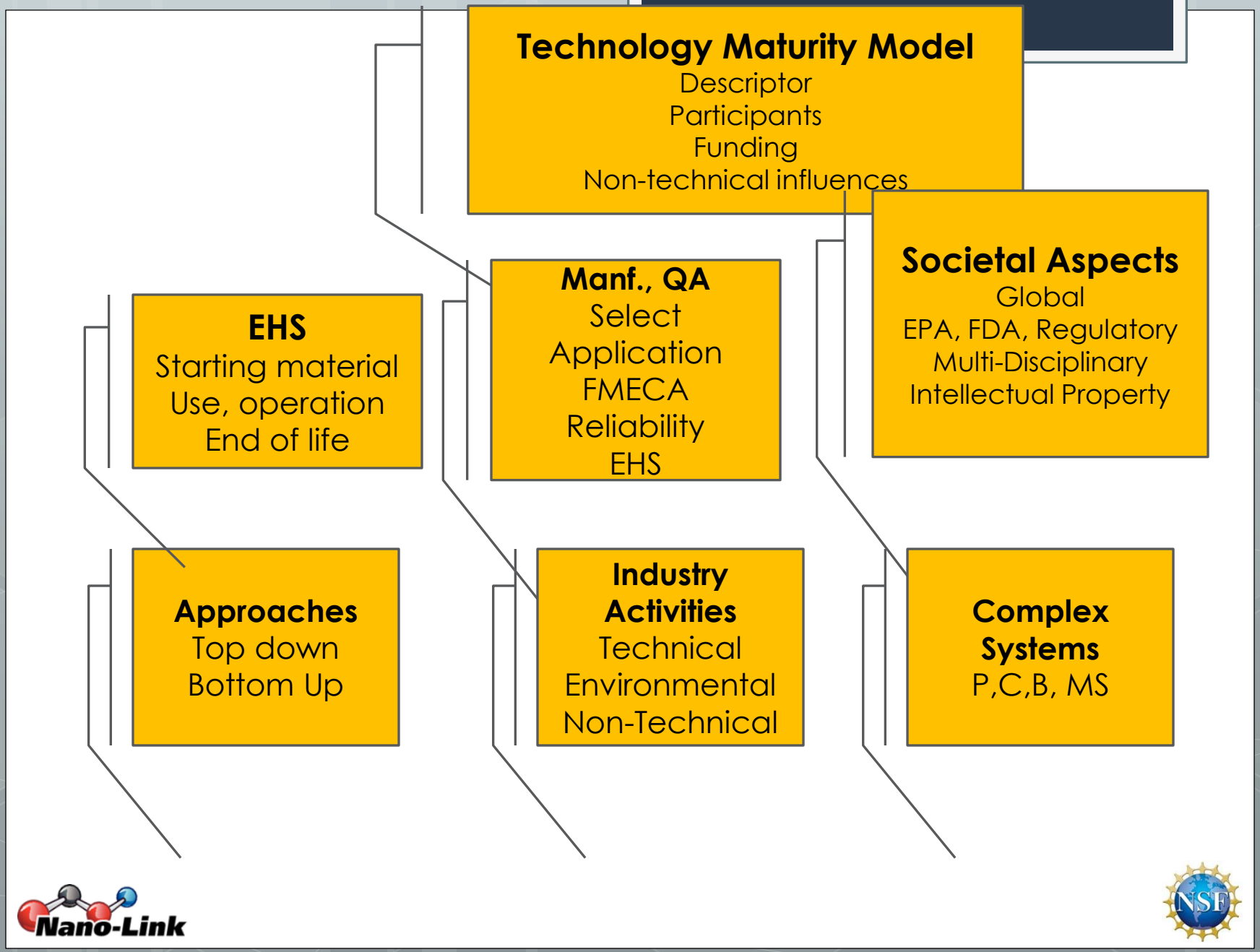
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Non-Technical
Complex Systems
P,C,B, MS

Practice
Examples from wbsites
What TM Phase – why?
Next steps to move forward
Will it make it? Why? Why not?

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Technical
Environmental
Non-Technical

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