



A Roadmap for US Robotics

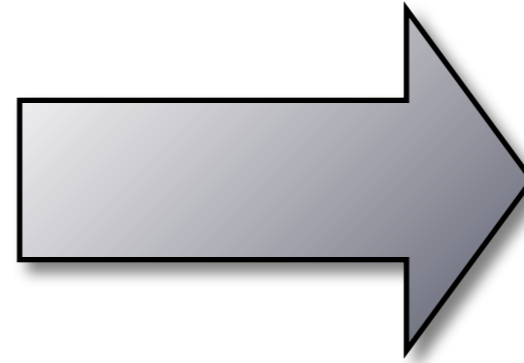
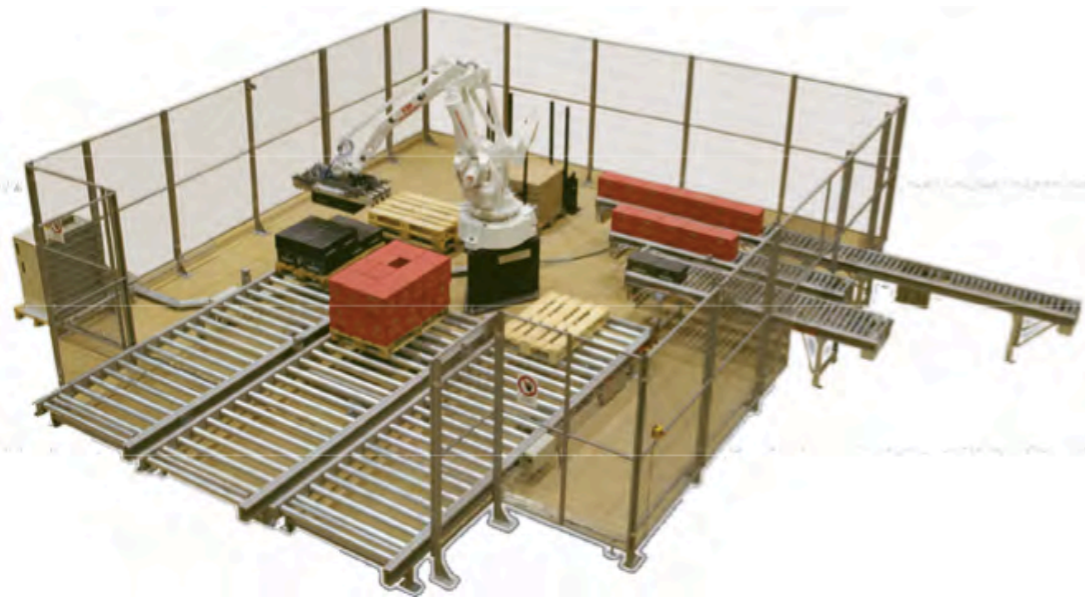
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Robot Evolution





Objective

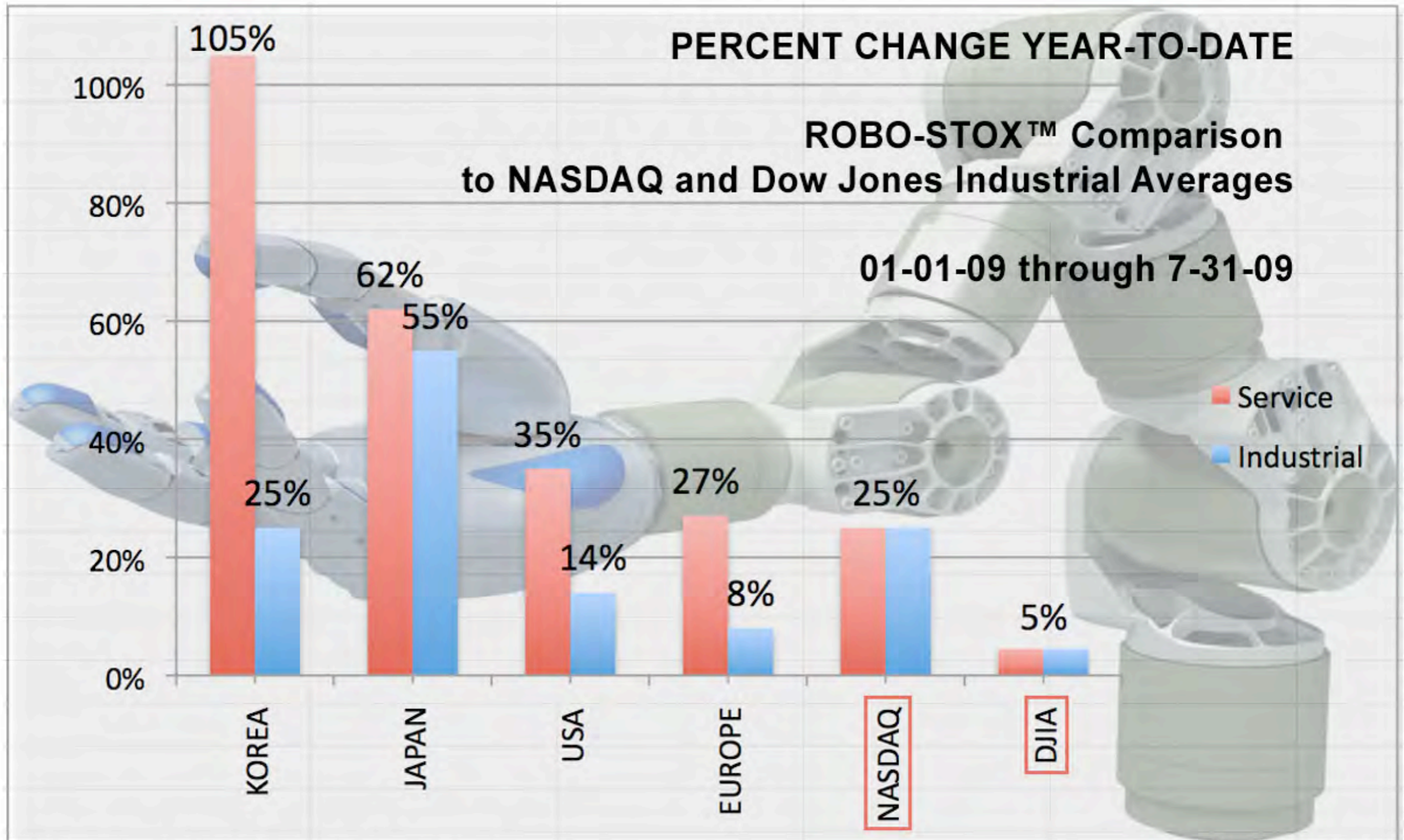
- To understand how robots can help improve quality of life
- In the workplace - as an assistant
- In our homes
- In leisure activities





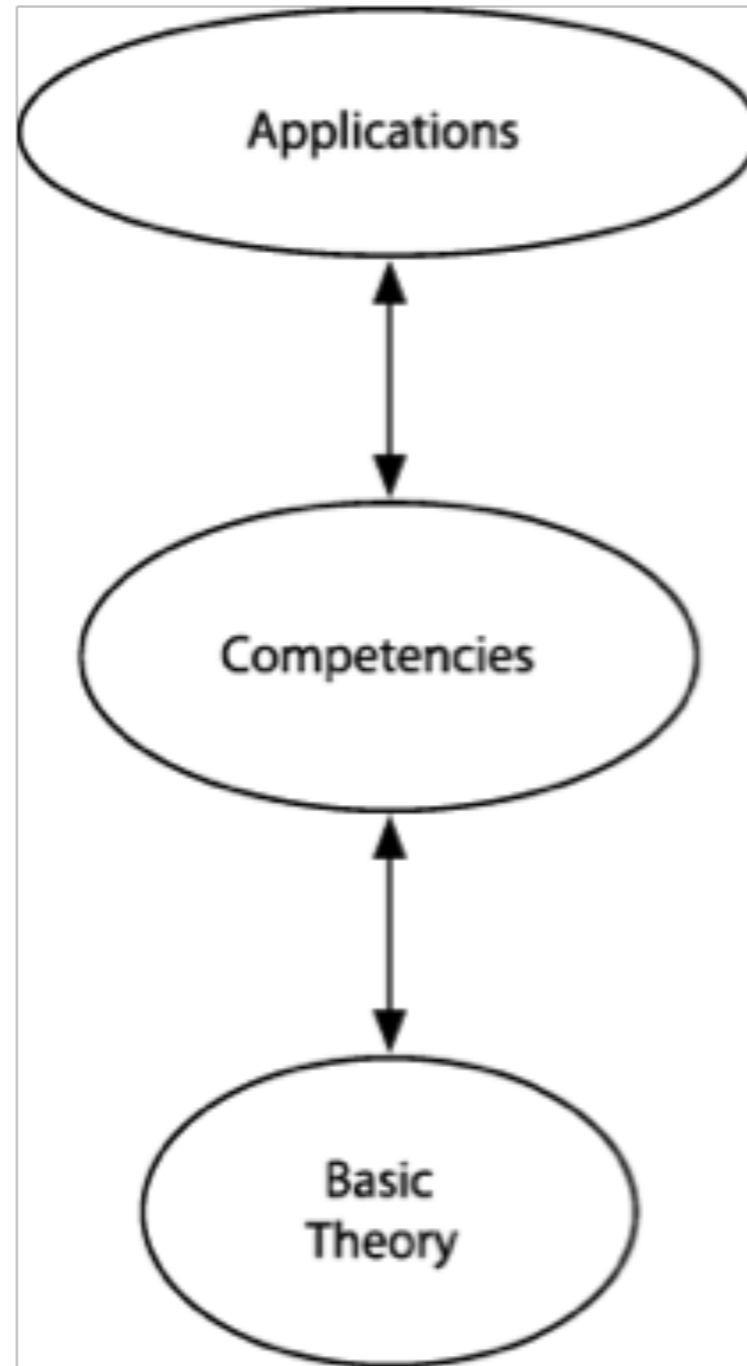
Where to go? - Roadmap

- Effort to investigate a roadmap for robotics in US
- What are the promising opportunities/applications
- What are the main obstacles to progress?
- What are the key science challenges?
- What is a good strategy to make progress?



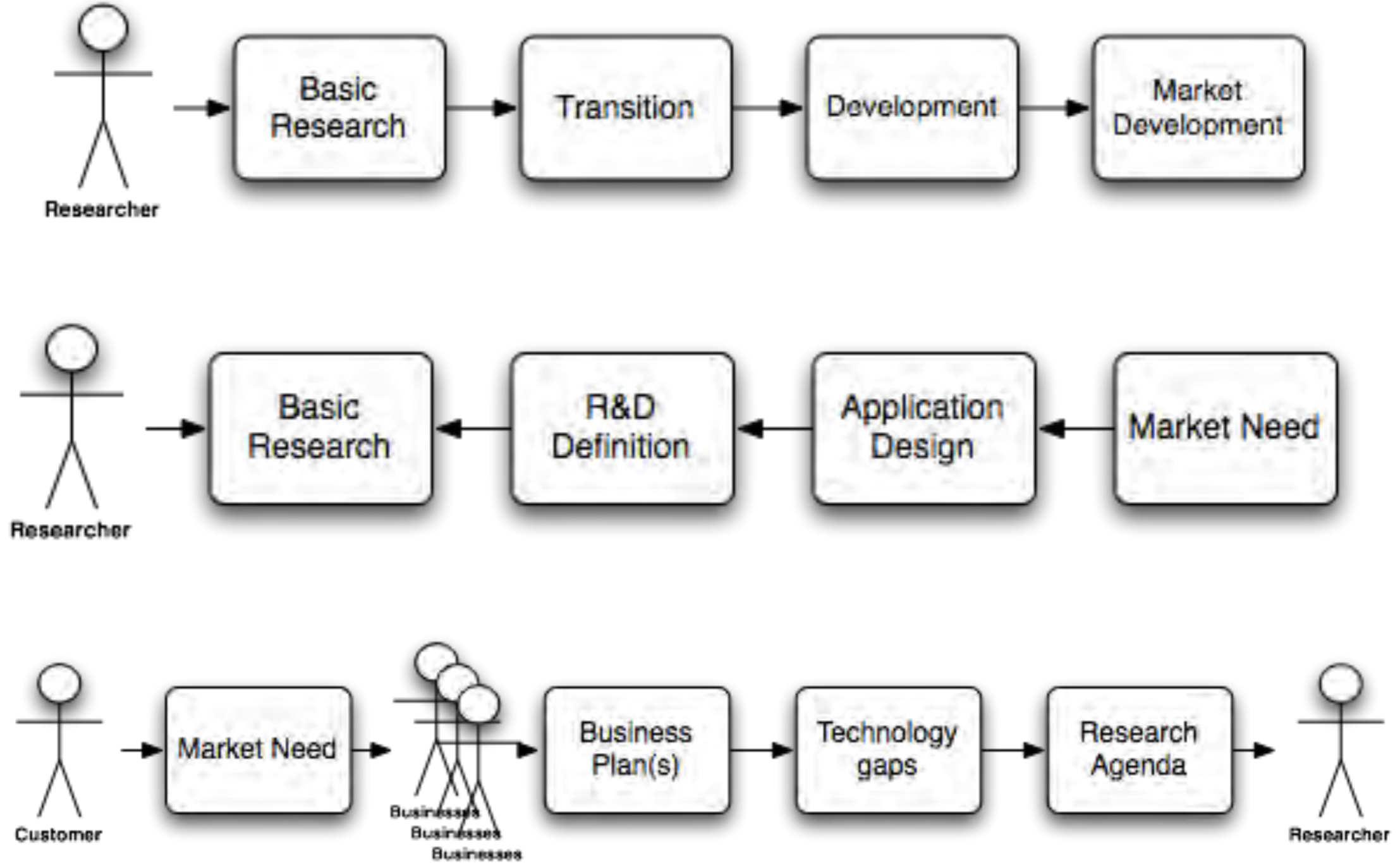


Process





Driving Research?



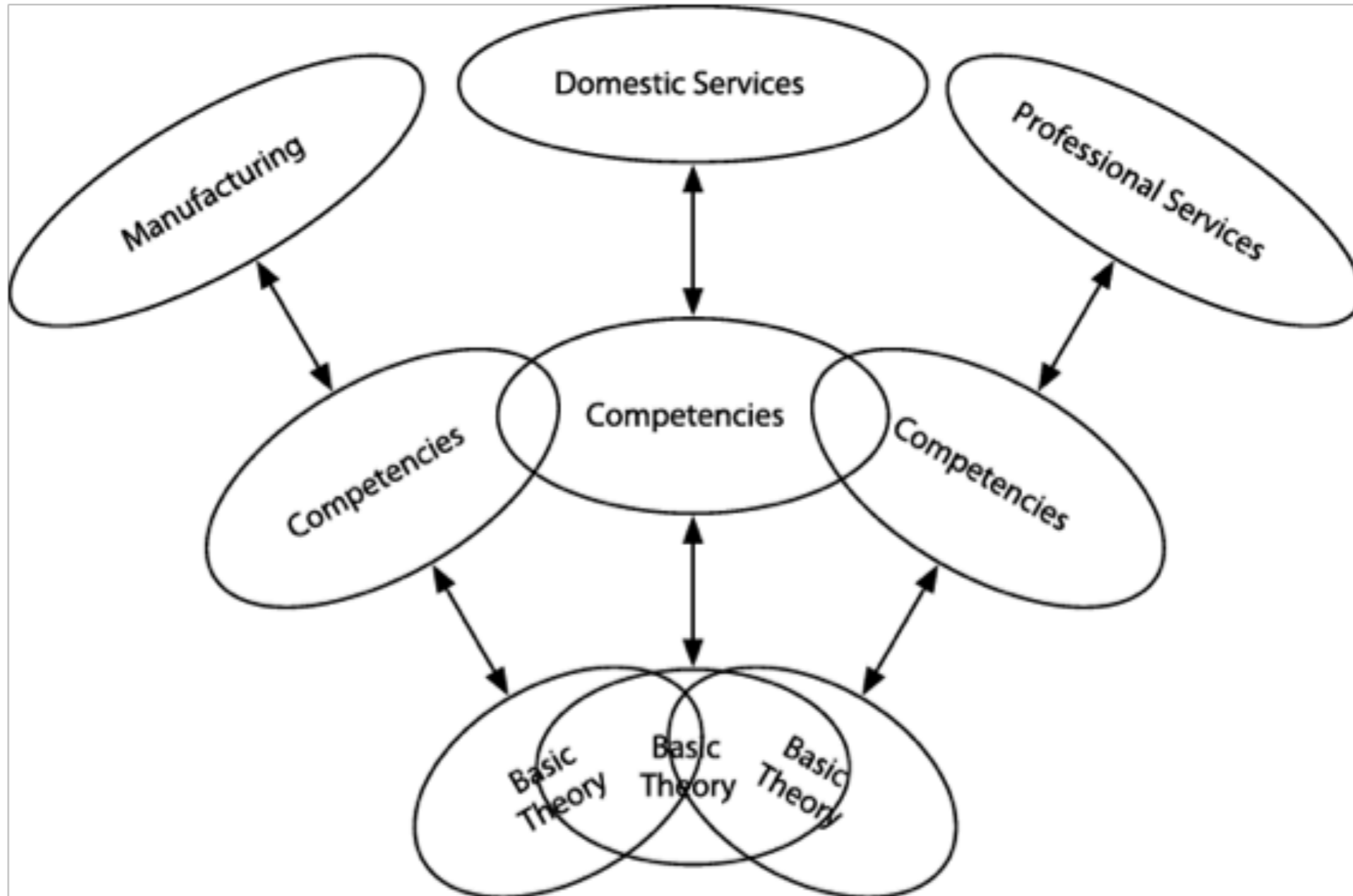


4 topical workshops

- Manufacturing & Logistics
 - Trinkle, Kumar, Goldberg, Christensen
- Service Robotics
 - Brock, Thomasmeyer, Christensen
- Medical / Healthcare
 - Mataric, Okamura, Christensen
- Emerging Technologies
 - Mason, Hollerbach, Christensen



Synthesis?



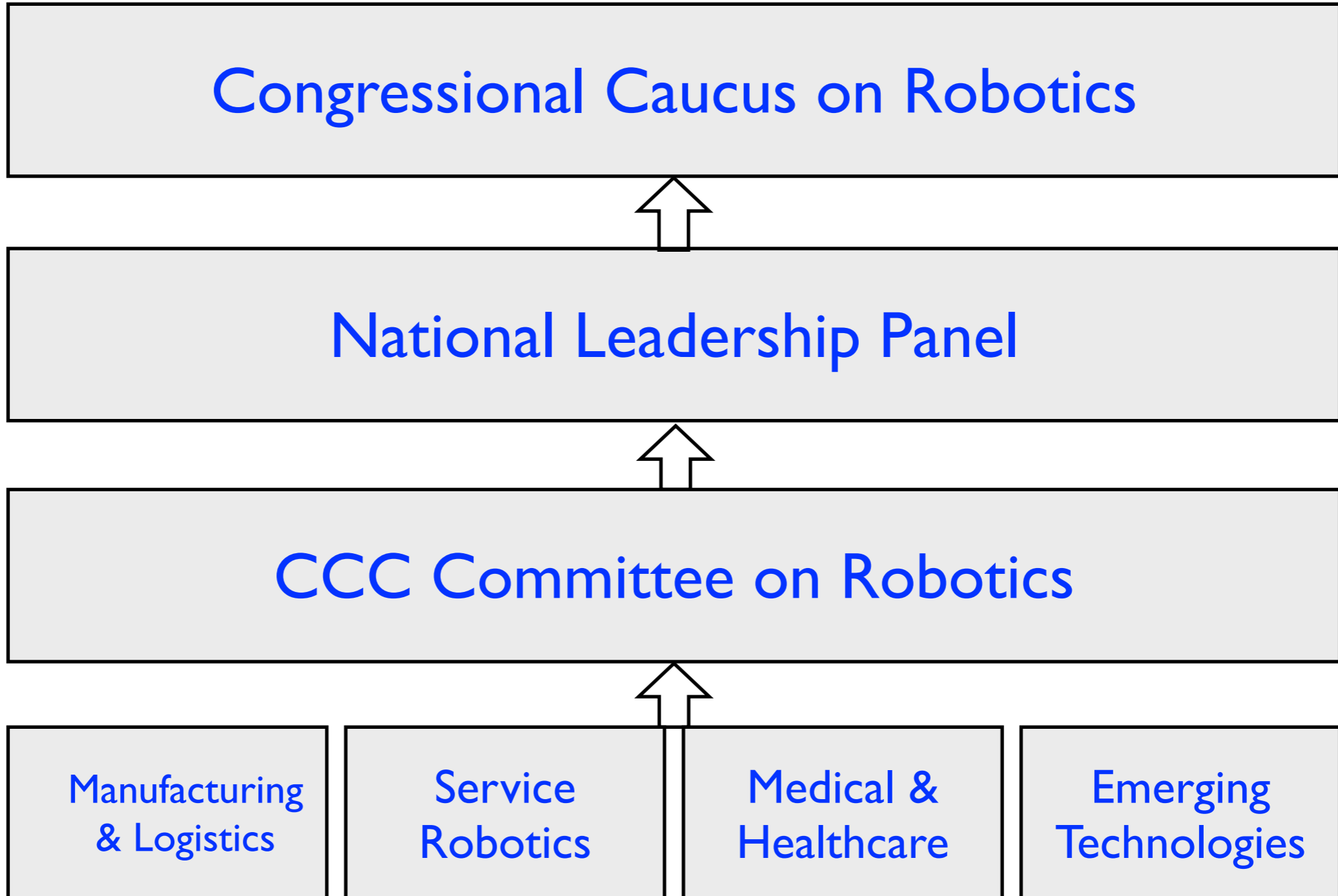


Timeline

March 08	Start of Effort, Call for Proposals
June/Aug 08	Workshops
Oct 08	Draft Topical Roadmaps
Dec 08	Completed Roadmap Draft
Mar 09	Community Feedback
May 09	Presentation to Congress
Jul 09++	Agency Discussions
Fall 09	Discussion of Programs
2011	Launch of Efforts



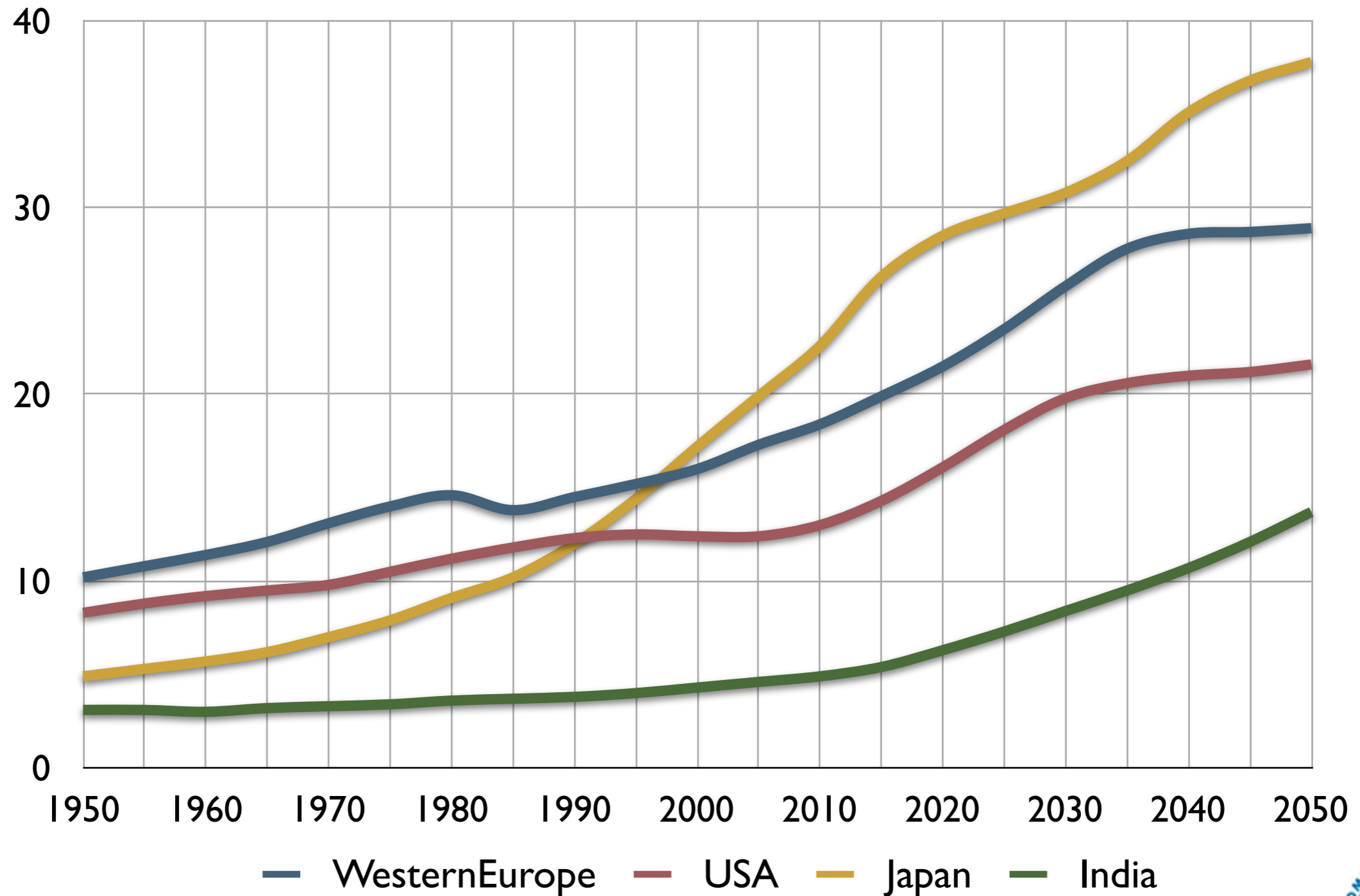
Organization





Societal Drivers

% of population above 65 (UN 2008 Data Series)





Background Analysis

Sector	Average Growth	Growth
Robotics – manufacturing, service and medical	20%	0-120%
IP Companies	21%	15-26%
Healthcare/eldercare	62%	6-542%
Entertainment/toys	6%	4-17%
Media / Games	14%	2-36%
Home appliances	1%	-4-7%
Capital equipment	8%	-4-20%
Automotive	0%	-11-13%
Logistics	21%	4-96%
Automation	4%	2-8%

Consolidated annual growth rates over a set of 280 U.S. companies for the period 2004-2007.





Analysis for each area

- Economic / Societal Drivers
- Core capabilities needed for applications
- R&D challenges
 - 5, 10 and 15 year expectations



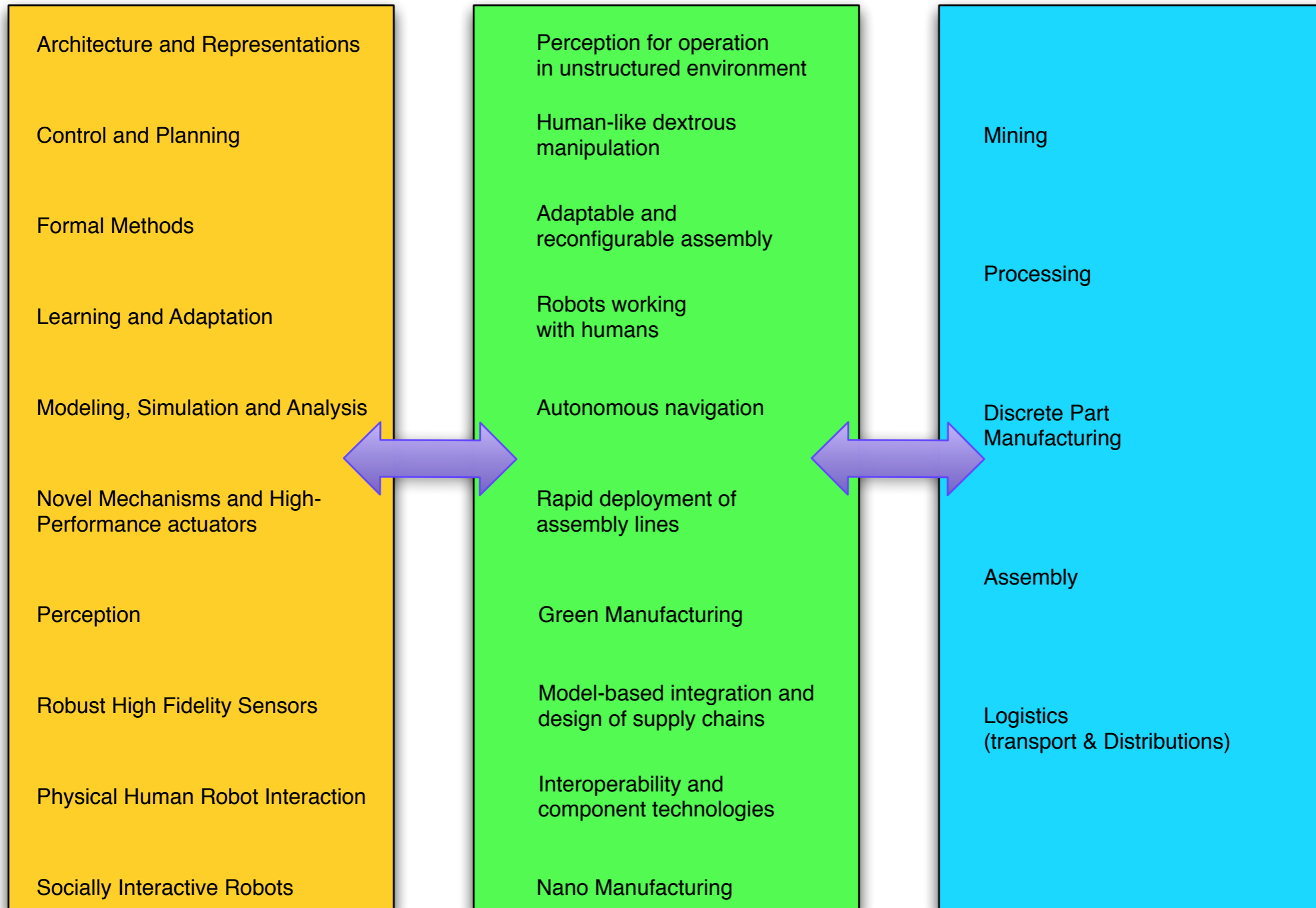
Manufacturing

- Large Scale Manufacturing
- Lack of SME Focus
- Flexibility is key to progress
- Logistics is major target
- Process consideration is key
- Perception, Learning & Safety





Issues





Medical & Healthcare

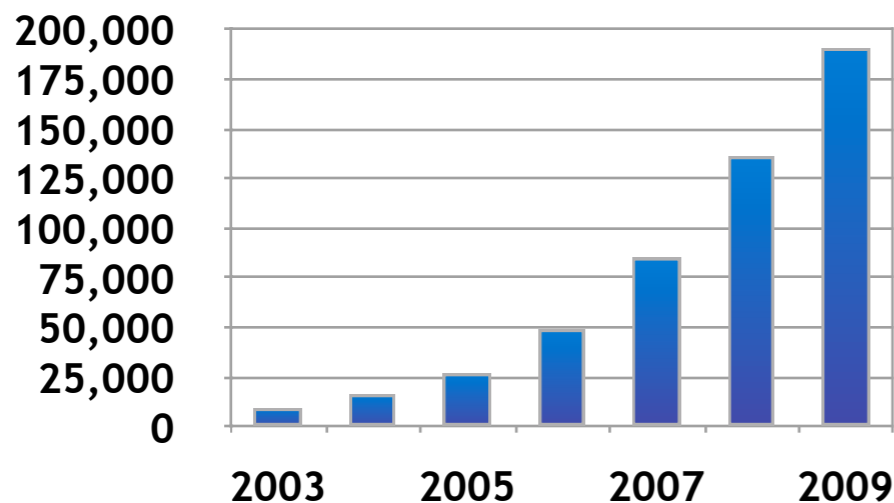
- Medical robotics the fastest growing area
- Surgery: less invasive, faster recovery, less side effects
- Rehabilitation: access to resources, adaptability, and home use
- Growing fast and has a lot of promise
- Perception, Dexterity, HRI, Learning



Medical Robotics



- Aging of society is seriously challenging the healthcare system
- Medical robotics facilitate faster, better and cheaper intervention
- Early results demonstrated for prostate and cardiac procedures.
- Need to develop and transition technologies from bench to bedside
- Where electronic patient record meets intervention





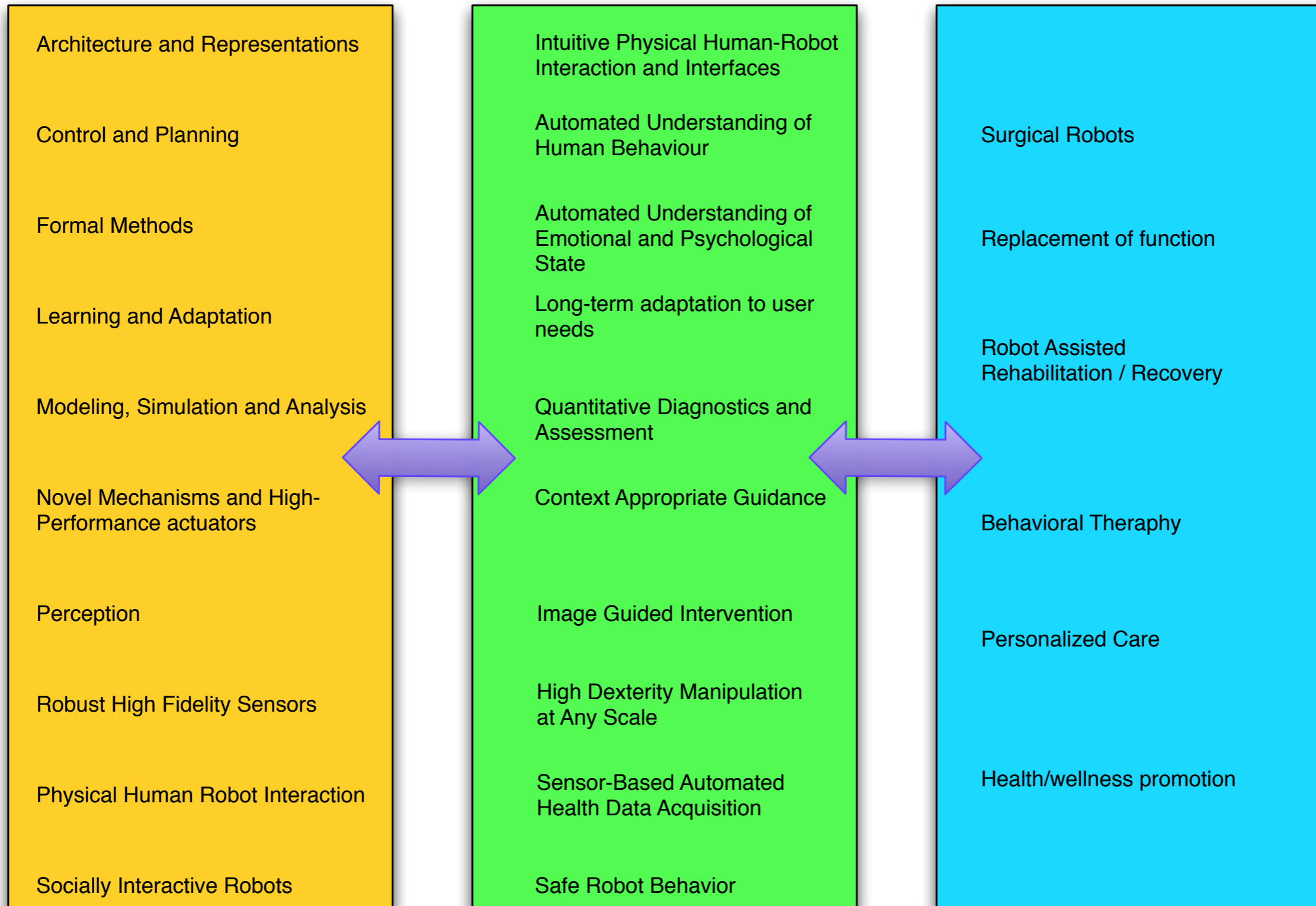
Healthcare

- Baby boomers/wounded veterans require services/quality of life
- Significant benefits to home-care services
- Freedom and personalized assistance
- New generation of flexible systems, ease of use, tied to home services





Issues





Service Robotics

- Professional Services
 - Agriculture, Mining, ...
 - Autonomy & HRI are key to success
- Domestic Services
 - Cleaning, Surveillance,
 - HRI, Autonomy, Perception and Dexterity
 - Price is very challenging



Professional Services



- Agriculture / Forestry
 - Automated Farms
 - Efficient use / HRI
- Mining
 - Logistics / Risk elimination



Domestic Services



- Cleaning
- Fetch & Carry
- Surveillance
- Gardening
- Time-savers

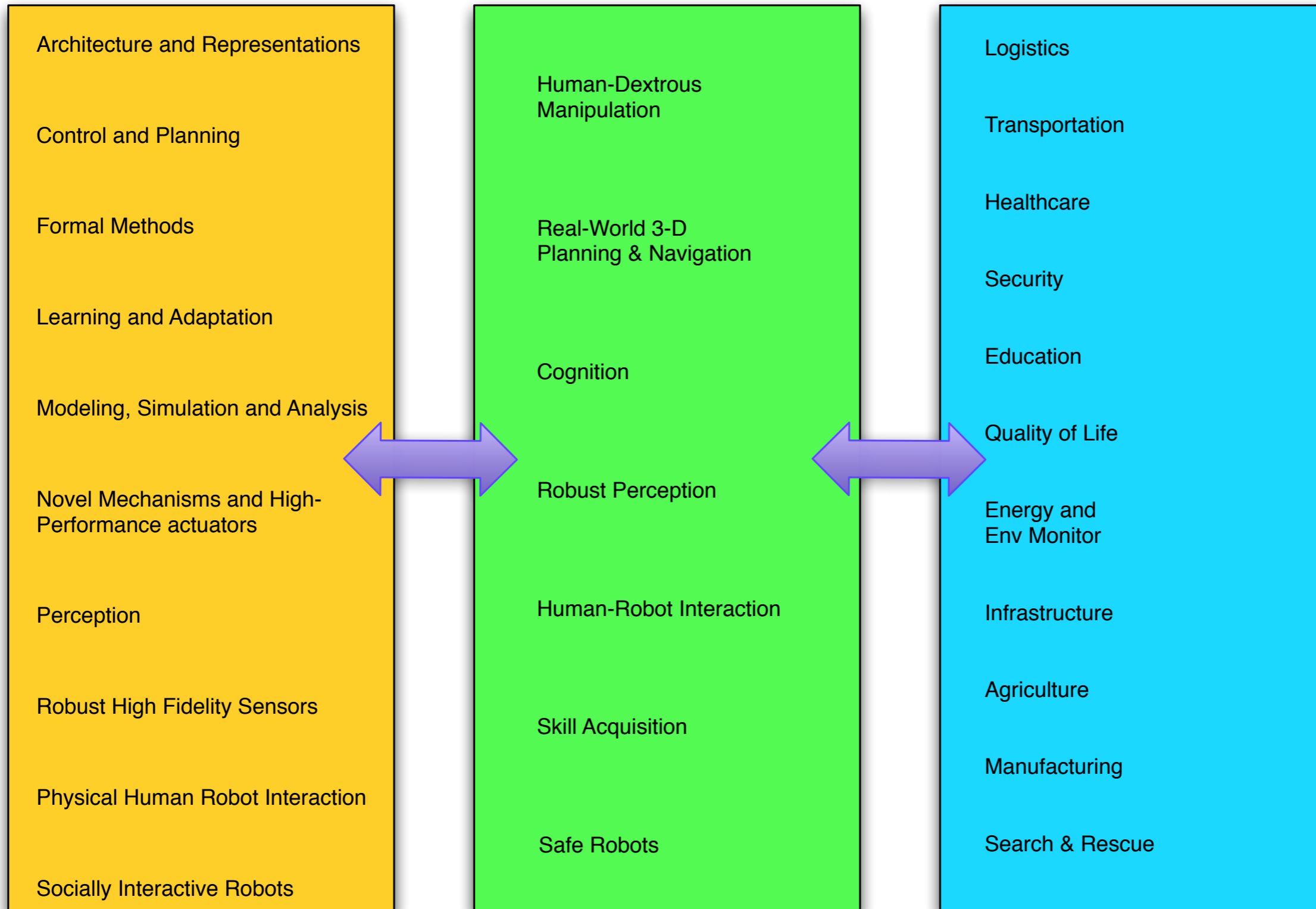


Introduction

- Robotics is a transformative technology
- Objective to define a roadmap for commercial use of robotics in the US
- Robots empower the american workforce



Issues





Blue Sky Research

- New technologies will change our perspective
 - Nano - new material, scaling down, medicine
 - Computing - ubiquitous access / embedding
 - Cheap / Reliable perception - closing the loop
 - Real world planning



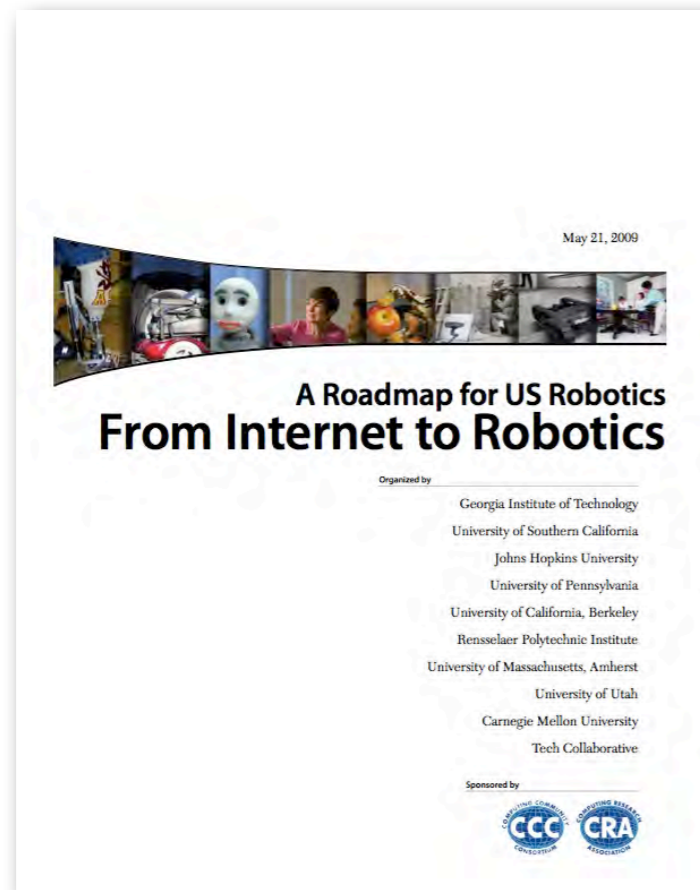
Education



- Developing the workforce
- Engaging students in STEM
- Educational outreach



CCC Study



- GT Coordination (0806-)
- Congress Presentation (0905)
- OSTP/White House (0912)
- Roll-out (10-Spring)
- Job Creation
- Healthcare
- Security/Services





Moving forward

- Academia / Industry / Government alliance
- Pushing for a broad agenda
- Roadmap has many of the details
 - <http://www.us-robotics.us>
- Creation of coordination across agencies and industries
 - National Summit on Robotics across agencies



Co-X Program

- Co-Workers
 - Manufacturing, Logistics & Medical Robotics
- Co-Inhabitant
 - Safe Cars, Home Assistance, Rehabilitation,
...
- Co-Protectors
 - Defense, Home Security, Private Security,
Economic Security