

TRENDS IN INDUSTRIAL RESEARCH PROGRAM LEADERSHIP (OR “WHAT DID THEY SAY?!!”)



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Naval-Industry R&D Partnership Conference

Outline

- **What is The Industrial Research Institute (IRI)?**
- **How do research leaders of winning companies operate? What is their “jargon?”**
 - **“Third Generation” R&D**
 - **Structured R&D Processes**
 - **Metrics**
 - **“Fourth Generation” R&D**
 - **Radical Innovation**
 - **Knowledge Management**
 - **“Real Options” for Research**
 - **IP Management**
 - **Management Decision Visualization**
 - **Reaching out to the World**
 - **But Really New!**
- **Summary**

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Industrial Research Institute

FOUNDED

1938 under the auspices of National Research Council

MEMBERSHIP

240+ major industrial companies that perform over 60% of the industrial R&D in the U.S. (seek profits; have labs; manufacturing/services)

REPRESENTATIVES

Senior leaders of R&D: VP's, CTO's

PRIMARY FOCUS

Management of R&D, technology, and innovation

MISSION

To enhance the effectiveness of technological innovation in industry

ORGANIZATION

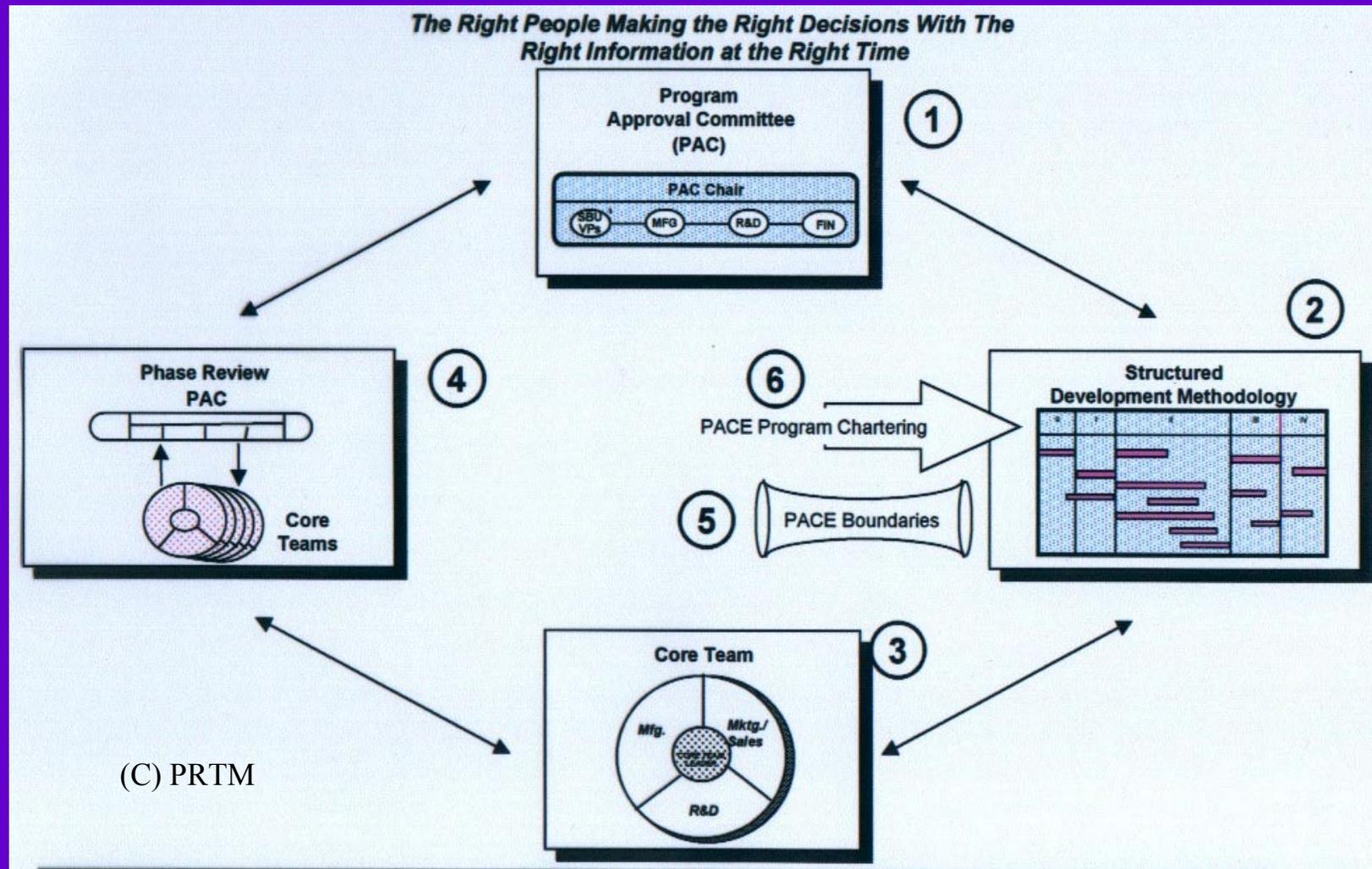
Board of Directors, 18 Committees, 8 networks, Headquarters Staff

Third Generation R&D

- Innovation is a “whole business” process.
- Programs must be market connected.
- Platforms must be continually updated.
- Portfolios are balanced according to long-term growth goals and risk tolerance.
- R&D process can be structured.
- Results from R&D can (and must) be quantified.

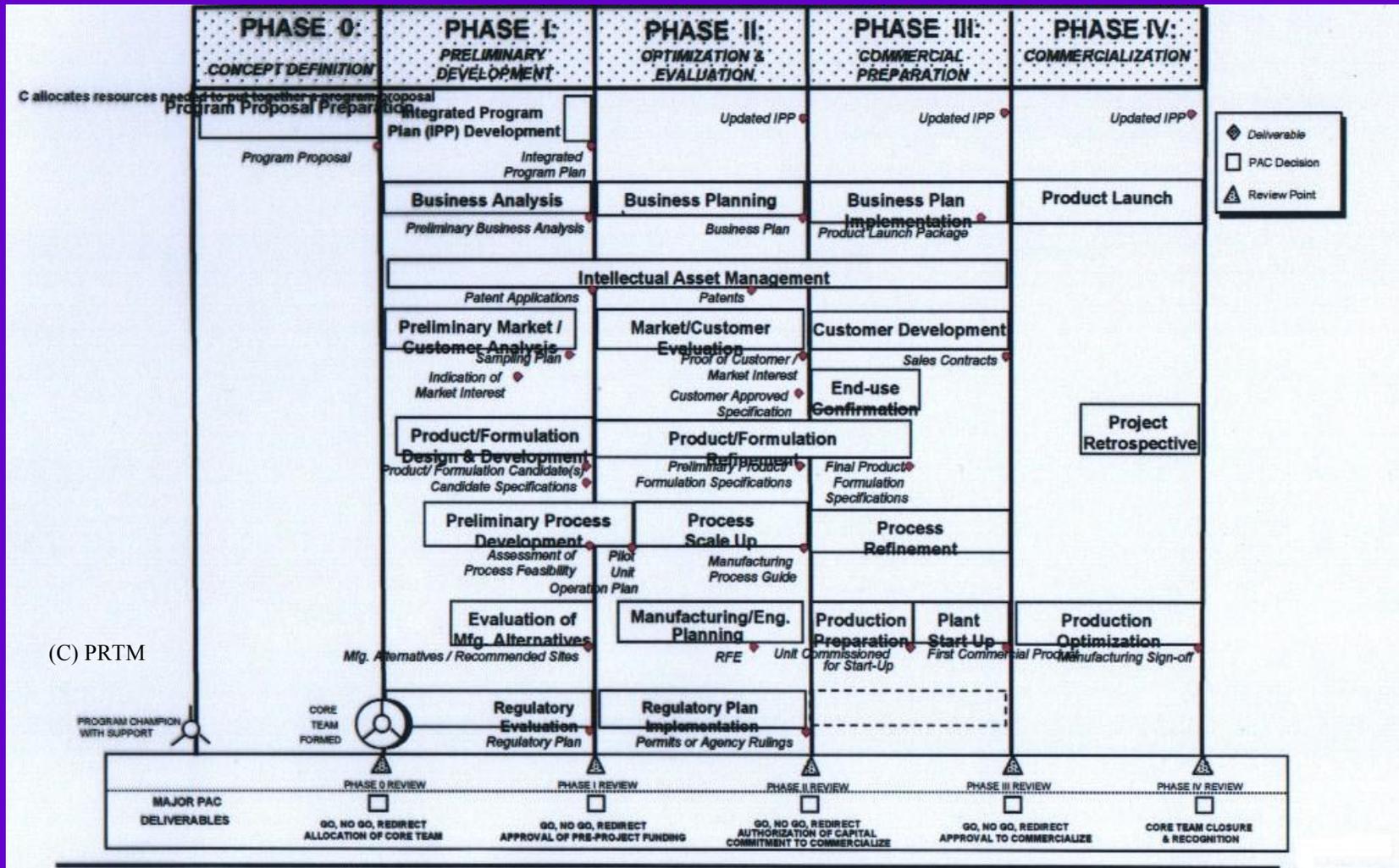
Loosely based upon Roussel, et.al., “Third Generation R&D, 1991.

Structured Development Process Overview



Structured Development Plan

("Stage/Gate," "Customer-Driven Commercialization")

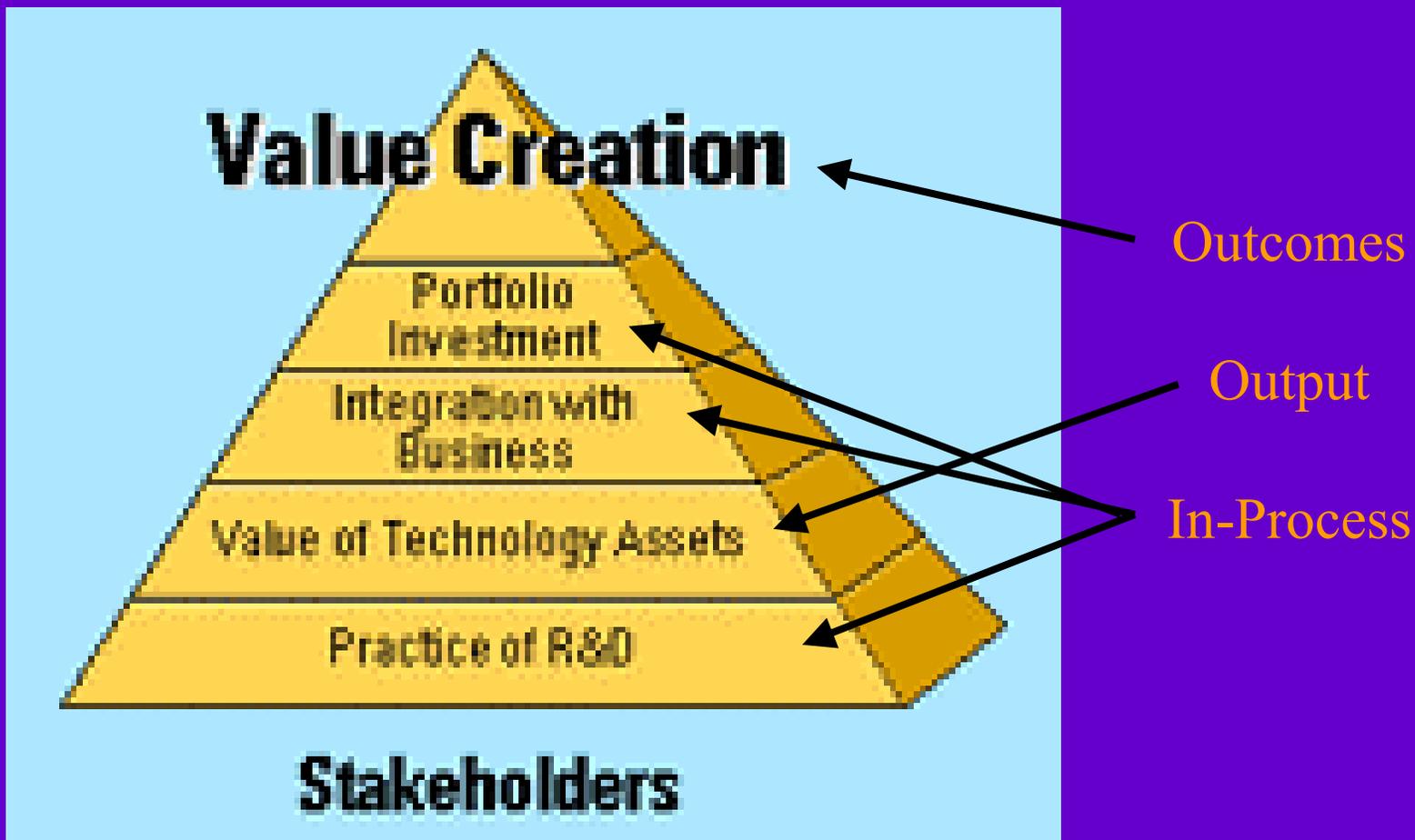


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Structured R&D Processes: Why Are Such Processes Desirable?

- **Product and Technology Development becomes an integrated, Whole-Business Task**
- **Faster introduction of products and processes occurs**
- **Those projects that reach later stages have higher success rates**
- **Costs can be more closely controlled**
- **More possibilities can be explored**

Metrics



Fourth Generation R&D

- Radical Innovation required for survival.
- Dominant Design is necessary for leadership.
- Spiral learning will include end-user feedback.
- Rate of learning is a core competency.
- Go before you know--but euchronistically.
- Know-how creates intellectual capital;
executable plans create strategic capital.

Loosely based upon Miller and Morris, "Fourth Generation R&D, 1999.

The Companies and Their Radical Innovations

- | | |
|--------------------------------|-------------------------------------|
| 1. Air Products | Oxygen Separation Technology |
| 2. Analog Devices | Air Bag Accelerometer |
| 3. DuPont | Biodegradable Polymer |
| 4. DuPont | Display Technology |
| 5. General Electric | Digital X-ray |
| 6. General Motors | Hybrid Vehicle |
| 7. IBM | Silicon Germanium Devices |
| 8. IBM | Electronic Book |
| 9. Nortel Networks | Internet Software Rental |
| 10. UTC / Otis Elevator | Bi-directional Elevator |
| 11. Polaroid | Memory Storage Device |
| 12. Texas Instruments | Digital Light Processor |

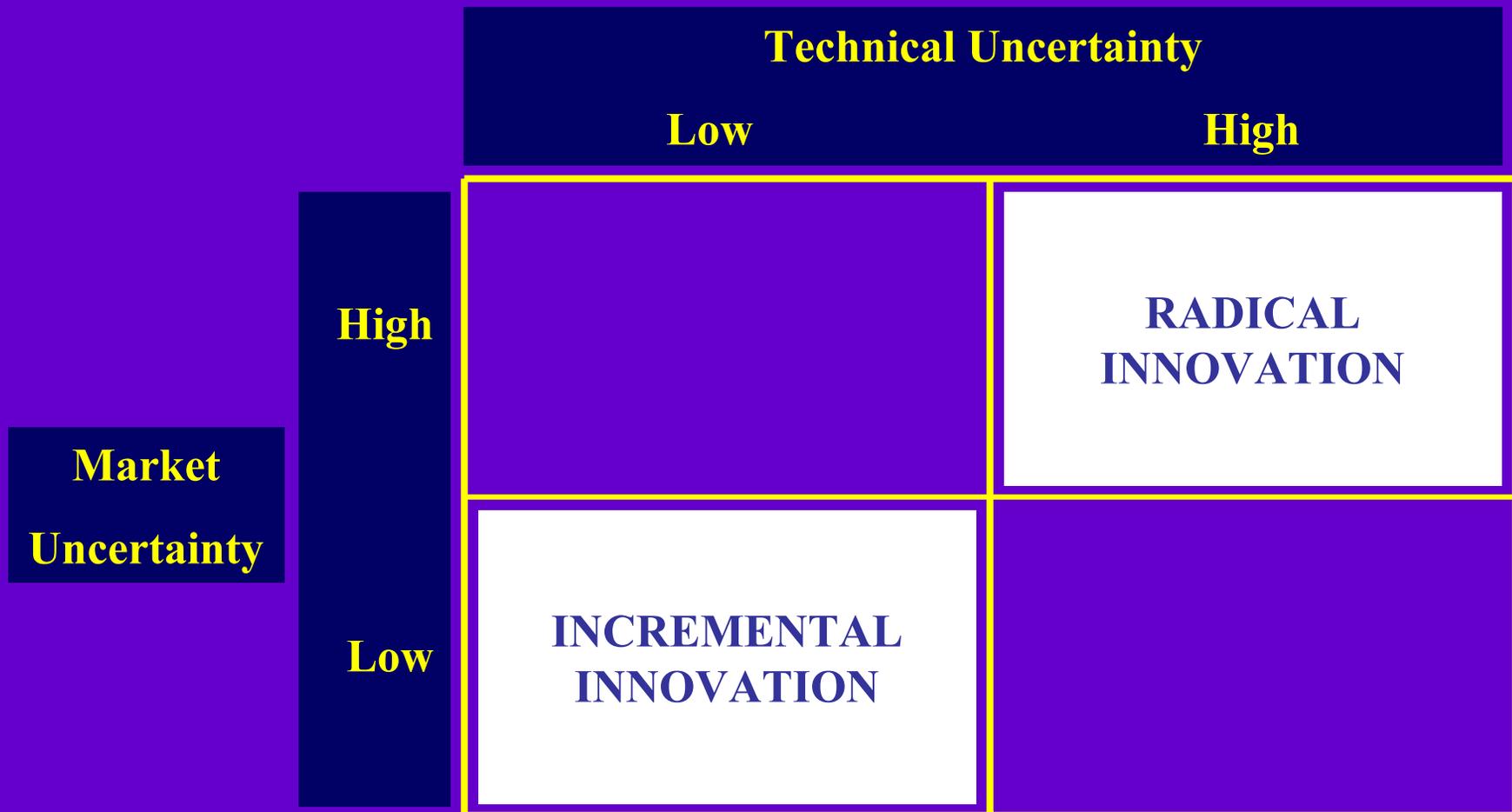
The Nature of the Radical Innovation Lifecycle

- ◆ Long term
- ◆ Highly uncertain, unpredictable
- ◆ Sporadic -- stops and starts, deaths and revivals
- ◆ Non-linear -- idea generation throughout
- ◆ Stochastic -- key players come and go, priorities change, exogenous events are critical
- ◆ Context dependent -- history, experience, corporate culture, personalities, and informal relations all matter



The tried and true management practices that work for incremental innovation are often inadequate for radical innovation.

Defining Radical Innovation



Radical Innovation

HI



Organization
Uncertainty

Resource
Uncertainty

Technical
Uncertainty

Market
Uncertainty

LOW

Incremental Innovation

Radical Innovation

Those firms that excel in developing, implementing and sustaining a radical innovation capacity will have a tremendous source of long-term competitive advantage.

Knowledge Flow in R&D

Conclusions

▪ R&D is different:

Business

- **Emphasis: Multiply the value of existing knowledge**
- **Key Solutions: Capture and retrieval**
- **Source of Solutions: Information Technology**

R&D

- **Emphasis: Create and recognize new knowledge for value creation**
- **Key Solutions: Collaboration, sharing, and people development**
- **Source of Solutions: Social science and anthropology for culture and behavioral change**

Knowledge Flow in R&D

Conclusions

- Minds contain the valuable knowledge
- Sharing / creating tacit knowledge is an interactive human process
- Archival and retrieval activities addressed – “Easy” and rapidly getting better
- Knowledge creation / facilitation remains an open field – “Hard” but valuable approaches available

R&D Valued as “Real Options”

- Strategic Capital resides in an organization’s plans and options for action.
- Executable plans are Real Options and, when exercised, convert into tangible capital.
- Risk can be managed in R&D through diversification (portfolios), “buying” options (structured development processes) and separation of unique and systematic risk.

From F. Peter Boer, “The Real Options Solution—Finding Total Value in a High Risk World, 2001

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IP Management

R&D only creates intellectual property.

Products just physical manifestation of IP.

IP is the life-blood of profit-seeking companies.

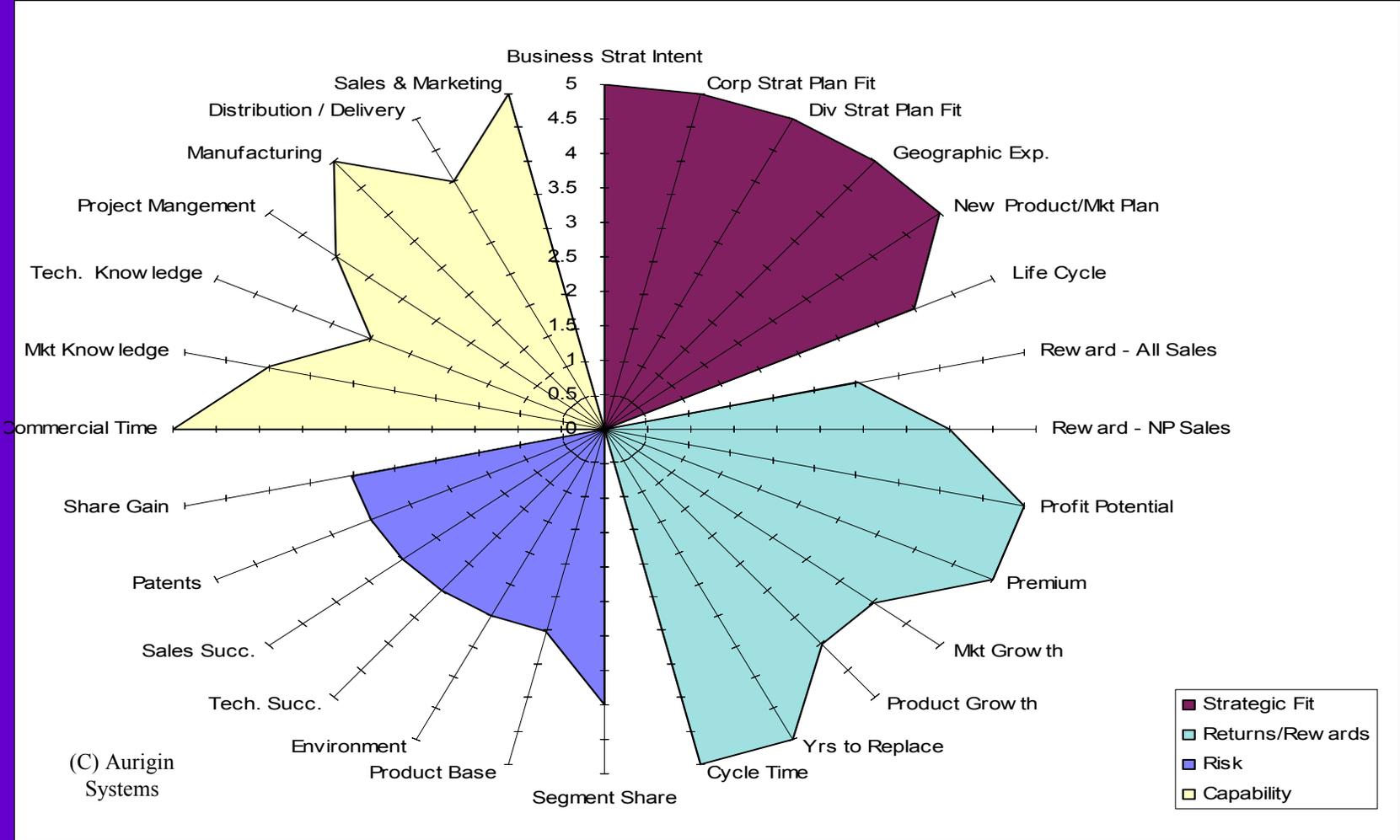
IP issues must be addressed up-front.

Let lawyers assist rather than drive the negotiation.

Visualization Tools

Useful to make high quality, high impact, “sticky” decisions quickly!

Spider Diagrams (Strategic Fit and Capability Map)



Globalization Hierarchy



But Really New!

- **Speed is everything, so:**
- **Unlearning is as important, and more difficult, than learning.**
- **Companies are designed to “flip.”**
- **Acquire & Develop and Connect & Develop are supplementing Research & Develop.**
- **In-house capital supplemented with venture capital.**
- **Spin-outs take risky projects “off-book.”**
- **Spin-out/Spin-in brings agility to large companies.**
- **R&D becoming involved in value creation by helping to imagine and realize radical business models--and then the technology to support them.**

Summary

- Leading companies continually improve practices to create and actualize new intellectual property
- These “better practices” develop a language of their own over time.
- Language is a major part of culture.
- Cultural barriers are impediments to partnership.
- We can’t think about what we can’t talk about.
- We must learn each other’s business languages to create a thriving partnership.

