Internships, Co-ops & Technology Collaboration With Industry: Some Best Practices

Dr. Ram Pai
Director
Advanced Technology Labs
Rockwell Automation, Milwaukee, WI

Agenda

1. Overview of R&D
2. Collaborative R&D examples
3. Best Practices
4. Internship & Co-op
5. Summary
Agenda

1. Overview of R&D
2. Collaborative R&D examples
3. Best Practices
4. Internship & Co-op
5. Summary

Copyright © 2010 Rockwell Automation, Inc. All rights reserved.

Rockwell Automation
Leading Global Provider of Industrial Power, Control & Information Solutions

- Annual Sales: $4.3 billion
- World Headquarters: Milwaukee, WI, USA
- Employees: 19,000
- Serving customers in 80+ countries

End users and machine builders (OEMs) rely on our comprehensive portfolio of products, software and services to deliver value and help them meet their objectives:

- **Faster time to market** — through speed, responsiveness & flexibility of automated manufacturing
- **Lower total cost of ownership** — through scalable, modular, energy-efficient and open automation control and information systems
- **Better asset management/optimization** — through diagnostics, condition-based monitoring, failure analysis and storage management
- **Broader manufacturing business risk management** — through process variability analysis, regulatory compliance and safety solutions

Copyright © 2010 Rockwell Automation, Inc. All rights reserved.
R&D Process

Global Customers

Products & Services

Business Units

Prototypes

Proactive Needs Assessment

- Business Strategy
- Target Markets
- Technology Roadmaps
  - Technical Trends
  - Deliverables
    - Technical Plan
  - Competency Needs
    - Assess Current Competencies
    - Proactive Needs Assessment
    - Analytics
    - Cost-share funding:
      - DOE, State Govt.
      - Customer
      - Open innovation
      - Consortia & R&D Partnerships
      - Internal R&D

Collaborative R&D

Agenda

1. Overview of R&D
2. Collaborative R&D examples
3. Best Practices
4. Internship & Co-op
5. Summary
What works

- Be in touch with industry's “ouch”
  - Only thing that stays constant is change
- Manage expectations, over-communicate
  - Manage perceptions and communicate in a way that Industry understands
- Develop a relationship based on trust & mutual respect.
  - Align with a Champion “inside” Industry, Funding will follow
- Address IP issues upfront and also revisit these periodically, if warranted
  - Allow Industry to take the lead. Develop
    - “umbrella” University/Industry collaborative agreements
    - standard “Services” agreements to enable agile response to FOAs
- Create and deliver on well-written, mutually developed goals
  - Industries may not necessarily align milestones with semester or quarters
- Network and collaborate with others. Do it early.
  - Industries expect Universities to provide multi-disciplinary approach to solving Industry problems. Collaborating with other Universities is OK

---

Renewable Energy: DOE Funding

- Algae can produce 10-20x oil/acre
  - marginal, non-arable land
  - saline/brackish water
  - large waste CO\textsubscript{2} vent resources
  - minimal competition to food, feed or fiber
- Need: Today’s dewatering is multistage process ~30% - 50% cost of algae cultivation

- ~$6M ARPA-E funding for Scaling & Commercialization of Algae Harvesting Technologies
  - novel harvesting, dewatering, drying system
  - reduce energy to < 40 W/kg concentrating from 0.3 g/L to 180g/L
- Partners: Univenture / Algaeventure Systems, Rockwell Automation, Case Western Reserve University (CWRU), Ohio University, NB Innovation
Renewable Energy: State funding

- Need: research center for wind-turbine development & education
- $3M State Grant to CWRU/The Ohio Wind Energy Research & Commercialization Center
  - Install 100kW, 225 kW, 1 MW Wind Turbines at CWRU
    - collaborative R&D platform
    - hands-on education for students
    - Collaborate w/ local Co. to advance design & manufacture of 8,000+ critical turbine components
    - Efficiency and cost improvements
      - near-term impact - create ~ 45 Ohio jobs

Industry partners: Rockwell Automation, Parker Hannifin, Lubrizol, Cleveland Electric Laboratories, Swiger Coil, Phillips Group, Wm. Sopko & Sons Co.

MEMS Fluid Health Sensor: Customer funding

- Need: Early detection of abnormal metal wear for fault detection & failure prevention for rotating machinery
- Partnered with a major aircraft company, CWRU to develop & test an on-line electrochemical cell MEMS sensor in a lubricating fluid
  - Able to use indication of chemistry of fluid to detect wear metal ions to provide an early indication of unusual material wear
  - Uses: Aircraft lubricant, HVAC coolant
Software: Open innovation

- Need:
  - connect a wide range of products using open communication standards
  - download license and royalty-free adapter stack, e.g., through SourceForge.net

- Developed at Odo Struger Lab/Vienna
  - an open-source EtherNet/IP lightweight, scalable, adapter-class software stack written in C for I/O adapter devices

Smart, Safe & Sustainable Manufacturing

Alt. Communications Media: “Connect & Develop”

- Need
  - Low cost Ethernet with good performance
  - Rugged, Application agnostic
  - Should be able to retrofit

- Collaborated w/Professor: well known school
  - Good track record, students and facility
  - Well developed technology, owns successful business in the public works sector

- Agreement w/University & our local CR&D lab
  - Developed technology, assigned IP rights
  - Developed proof-of-concept prototypes
  - Tech transfer to U.S. CR&D lab


Smart, Safe & Sustainable Manufacturing

Copyright © 2010 Rockwell Automation, Inc. All rights reserved.
Advanced Materials: Consortium

- Research
  - power, controls & energy fields
  - new products & processes that foster economic growth of regional companies
- Workforce Development
  - Train a dynamic workforce - engineers, scientists & technicians in the field of power & energy
- Strategic Partners and Networks
  - between Academic Institutions, Industries, Government & Non Government Organizations

Members: Rockwell Automation, Kohler, Eaton, The Lynde & Harry Bradley Foundation, NETL, ATC, DRS Technologies, Regenco, WE Energies, MSOE, UWM, Marquette University

Smart, Safe & Sustainable Manufacturing

R&D Partnership

Research and Development powerhouse since 1962
Successful R&D Business, with:
- Contract R&D for the Government
- Commercial R&D for strategic commercial customers
- Niche product spin-offs and transition to businesses

Technology Areas

Materials
- Structural Materials
- Energy & Environment
- Thermal & Flow Physics
- Materials Testing & Analysis

Optics
- Photonics, Liquid Crystal Devices
- Fiber Optic Sensing & Comm
- Optical Sensing Subsystems
- Optical System Integration

Information Sciences
- Autonomous Systems
- Sensor Exploitation
- Command & Control
- Info Assurance/ Anti-Tamper

Electronics
- III-V Semiconductors
- MEMS Technologies
- Mixed Signal Products & Design Services

Smart, Safe & Sustainable Manufacturing
Agenda

1. Overview of R&D
2. Collaborative R&D examples
3. Best Practices
4. Internship & Co-op
5. Summary

What works

- Be in touch with industry’s “ouch”
  - Only thing that stays constant is change
- Manage expectations, over-communicate
  - Manage perceptions and communicate in a way that Industry understands
- Develop a relationship based on trust & mutual respect.
  - Align with a Champion “inside” Industry, Funding will follow
- Address IP issues upfront and also revisit these periodically, if warranted
  - Allow Industry to take the lead. Develop
    - “umbrella” University/Industry collaborative agreements
    - standard “Services” agreements to enable agile response to FOAs
- Create and deliver on well-written, mutually developed goals
  - Industries may not necessarily align milestones with semester or quarters
- Network and collaborate with others. Do it early.
  - Industries expect Universities to provide multi-disciplinary approach to solving Industry problems. Collaborating with other Universities is OK
What may not work

- Ignoring current industry technology, standards and practice
  - Industry goal is to commercialize technology
- Receiving funds and switching to autopilot
  - Do not miss milestones or change goals without consulting Industry
- Engaging with the competition
  - If there is need for pre-competitive R&D, then engage in a Consortium
- Taking industrial partner for granted
  - Exercise care when exploring new projects using intimacy gained with Industry
- Writing IP Agreements exclusively favoring University interests
  - Strike a balance by catering to needs of Industry in drafting IP agreements
- Publishing without consulting with Industry
  - Unauthorized release of information could irrevocably ruin trust

IP: discussion topics

**Universities**
- Resources
- Have graduate students
- Desirous of owning IP.
  - spin-off companies, licensing revenues
- Publish papers, reports, thesis

**Industry**
- Offer funds, facilities
- Have domain expertise/background IP
- Desirous of owning foreground IP
  - Generate revenue stream: new products/customers/markets
- File patents, publish white papers

- R&D increasingly becoming global
  - What if Governments/Universities offer favorable terms elsewhere?
- Students sharing IP
  - Has the student signed any agreement with the University?
- Abiding by Dept. of Commerce Export requirements
  - Does the student have clearance to work on the topic?
Overview Of Internship & Co-op Opportunities

**Internship**
- Most common form of opportunity
- Students hail from various disciplines
- 10 – 12 weeks over the summer
- Employers may offer housing assistance
- May extend into part-time work during the school year, if
  - employer is local, or,
  - student can work remotely

**Co-op**
- Less common than internships
- Most common among engineering students
- Student takes a semester off to work full-time
  - Typical May–Dec / Jan-Aug
  - May delay graduation
Desirable Student Profile

- Analytical & innovative approach
- Problem solving skills
- Written/verbal communication
- Ability to lead & follow
- Customer-centric outlook
- Collaborative spirit
- Global perspective
- Flexible nature

Demonstrated track record of excelling in Education, Leadership and Work

Agenda

1. Overview of R&D
2. Collaborative R&D examples
3. Best Practices
4. Internship & Co-op
5. Summary
Summary

• Industry is desirous of generating revenue stream from Innovations
• Know your industry partner
• Develop relationships based on mutual trust
  – People constitute the most important resource
• There is more than one method to work with Industry
  – R&D opportunities for partnership are not local anymore
  – Learn what works and what does not, and remember what did not work!
• Develop fair and equitable processes and procedures
  – IP agreements are likely to take the longest time. Leverage relationship to develop “umbrella” agreements for agile response to FOA’s.
• Have fun, celebrate victories
  – “Success begets success”

Questions