The
Roanoke Higher Education Center

Roanoke Valley and New River Valley Industry Clustering

'A Study to Examine Potential Development at the Roanoke Higher Education Center'

Presented to
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Roanoke, VA

In partial fulfillment of EDCI 5974
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Study Synopsis

Dr. Tom McKeon, Executive Director of the Roanoke Higher Education Center, was contacted in December 2007 in order to discuss the potential of using the Roanoke Higher Education Center (RHEC) as a site for completion of an independent study at Virginia Polytechnic Institute and State University (Virginia Tech). The RHEC was developed from legislation in 1997 (HB 1180) that established the Roanoke Higher Education Authority. It presently functions to manage the facility, schedule use of space, and provide centralized services to increase cost efficiency of the Center. As partial fulfillment of doctoral coursework in the Department of Educational Leadership and Policy Studies, Higher Education Program, the RHEC was chosen as a site due to the nature of its role in higher education.

Upon approval of the Graduate School, a 'job description' was agreed upon, and it was noted in an email to the RHEC staff on January 23, 2008:

> John's primary project during this semester will be to develop information and an infrastructure for the Center to become more involved in assessing the education and training needs in the region (Roanoke and New River Valleys). That will include identifying the major business clusters in the region, identifying the industries within the clusters and sources within those industries through which we can find education and training needs, and recommending the best methods (i.e. surveys, focus groups, advisory committees, etc.) for us to use going forward to conduct needs assessments.

The following pages document the progress of this independent study during the Spring semester of 2008. There is also a companion power point presentation. The RHEC staff has been outstanding in making this study possible, and in providing the necessary tools to work effectively. By no means is this study complete and final, as economic forces of the past few months have indicated the potential for serious turbulence in industry for the next few years.

Defining Industry Clusters

Industry clusters were coined by Michael Porter in his book *The Competitive Advantage of Nations* (1990). The concept actually dates back to the 1890's in Alfred Marshall's Principles of Economics text. Industry clusters are rooted in supply and demand economic functions.

Rosenfeld (1990) defined industry clusters as "a geographically bounded concentration of similar, related or complementary businesses, with active channels for business transactions, communications and dialogue that share specialized infrastructure, labor markets and services, and that are faced with common opportunities and threats." In his paper "Bringing Business Clusters into the Mainstream of Economic Development," Rosenfeld (1990) emphasizes the importance of the role of social interaction and firm cooperation in determining the dynamic nature of a cluster.

Numerous factors drive an industry cluster, including competition among rival firms, agglomeration economies, labor force skills, technology transfer, knowledge transfer, and social infrastructure (Doeringer and Terkla, 1995). Labor force skills and knowledge transfer are of particular importance for this project.

Doeringer and Terkla (1995) suggest looking beyond individual industries and recognizing that individual firms are part of a much larger industrial system. Industry clusters should have a much broader definition to include both horizontal and vertical relationships, and both direct and indirect linkages. Many practitioners have relied on simply defining industry clusters as a concentration of employment in a single industry. The literature argues that this simply represents an industry concentration, and ignores the functional relationships between industries and the interdependent and dynamic relationships that characterize clusters (Doeringer and Terkla 1995, Rosenfeld 1997).

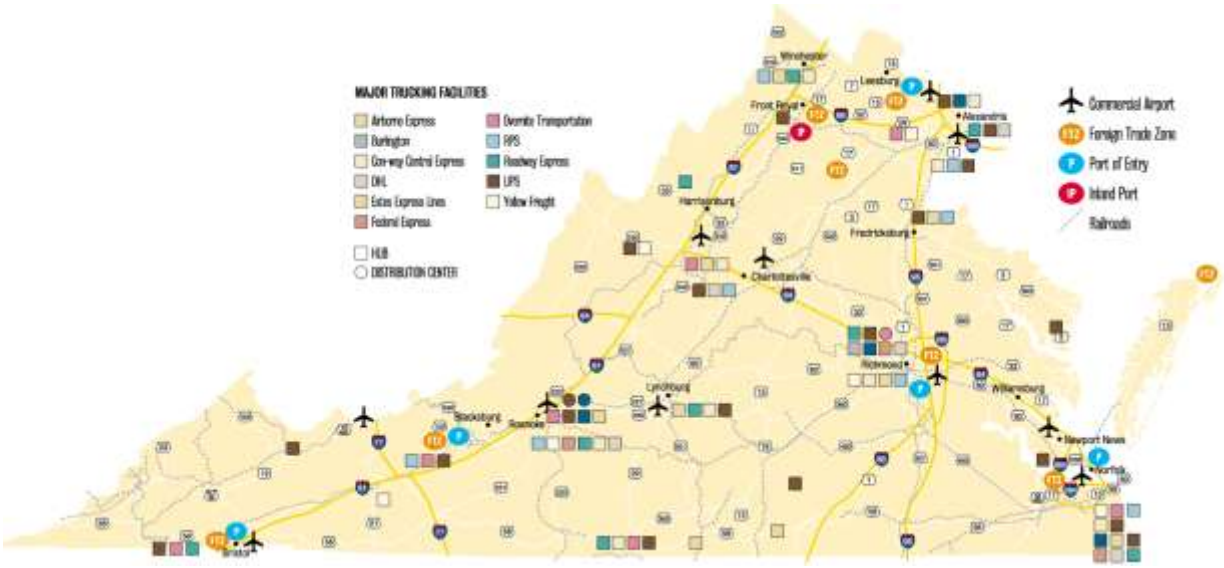
In defining industry clusters for the Roanoke Valley and New River Valley, it became apparent that some disagreement existed as to what the industry clusters actually are due to the fact that many methods can be used to determine the clusters. The following examines how the Commonwealth of Virginia (Virginia Economic Development Partnership) defines industry clusters for the state. Included are these ten (10) clusters: aerospace, automotive, biosciences, electronics, nanotechnology, food processing, global logistics, modeling and simulation, plastics, and wood products. Data available from the Commonwealth for each cluster varied. Some data included specific industries, maps, tables, and bar graphs. Industry examples are as follows:

(1) Aerospace Industry Cluster in Virginia

AeroAstro
Agusta Westland
AIRBUS
Allied Aerospace
Atlantic Research
Aurora Flight Sciences
BAE Systems
The Boeing Company
Dowty Aerospace
Electro-Tec
Exostar
General Dynamics
Howmet
Kollmorgen
Lockheed Martin
Goodyear Tire & Rubber
Northrop Grumman
Orbital Sciences Corporation
Raytheon
Rolls-Royce North America
Smiths Aerospace
Spot Image
Swales Aerospace

(2) Automotive Industry Cluster in Virginia

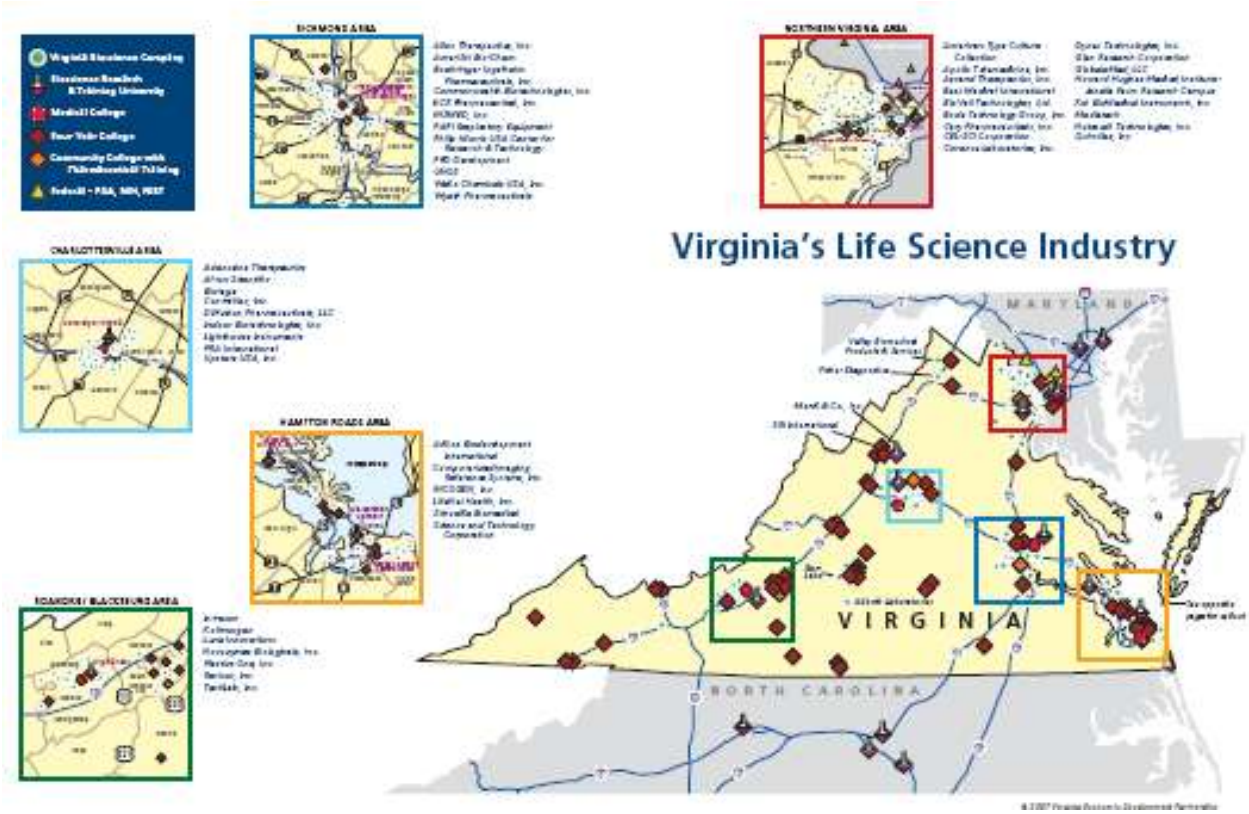
Alcoa Wheel Products
Carlisle Motion Control
Continental Teves
Corning
DuPont
Dynax America
Eagle-Picher
Federal Mogul
Goodyear Tire & Rubber Co.
Intermet
International Automotive Components
Koyo Steering Systems
MeadWestvaco
Narricot Industries
Rehau
Schrader Bridgeport International
Siemens VDO Automotive
Tenneco Automotive
Timken
Toray Plastics
TRW
Usui International
Volkswagen of America, Inc.
Volvo Trucks North America
Wytheville Technologies
Yokohama Tire



(3) Bioscience Industry Cluster in Virginia

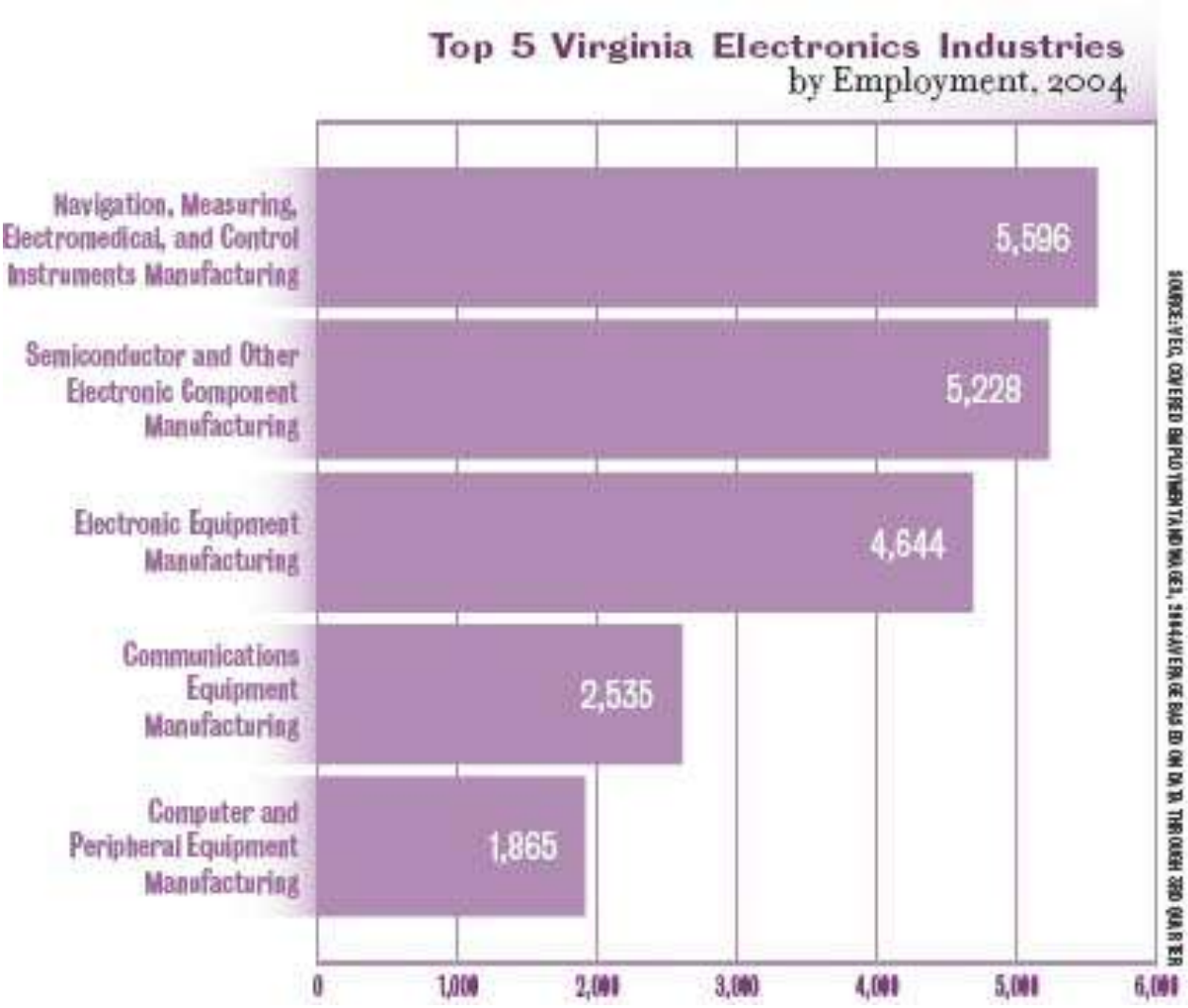
Abbott Laboratories (Ross Products Division)
American Type Culture Collection
Barr Laboratories
Biotage
Biovail Technologies
Boehringer Ingelheim
Commonwealth Biotechnologies, Inc.
Covance Laboratories, Inc.
EPL, Inc.
Incogen, Inc.
LifeNet Health Inc.
Mediatech, Inc.
Merck & Co., Inc.
Novozymes Biologicals, Inc.
PPD Development
PPL Therapeutics, Inc.
PRA International
Quintiles

Fisher Scientific
Genetics and IVF Institute
Howard Hughes Medical Institute
Wyeth Consumer Healthcare
SRI International
UNOS
Wako Chemicals USA, Inc.
Wyeth Pharmaceuticals



(4) Electronics Industry Cluster in Virginia

ABB Power T & D Company
Aspen Motion Technologies
Canon
Delta Star, Inc.
Technology, Inc.
Diebold Southeast
Electro-Tec Corporation
GE Fanuc
General Electric
Genie Company
Hubbell Lighting, Inc.
Qimonda
Kollmorgen Corporation
Line Power Manufacturing Corp.
Maida Development Company
Manufacturing Carbone Kirkwood Micron
Moog Components Group Inc.
Northrop Grumman Orbital Sciences Corporation
Plastics One Inc.
Pyott-Boone Electronics Inc.
Raytheon Systems
Times Fiber Communication
Valcom, Inc.



(5) Nanotechnology Industry Cluster in Virginia

4Wave, Inc.
Abtech Scientific, Inc.
BAE Systems
CP Films, Inc., a subsidiary of Solutia Inc.
Industrial Science & Technology Network, Inc.
Qimonda
NanoTITAN
LEICA Microsystems
Lockheed Martin
Luna Innovations, Inc.
Luna nanoWorks
Materials Modification, Inc.
Micron Technology
NanoMatrix, Inc.
NanoSonic, Inc.
MITRE Corporation
Philip Morris USA
Northrop Grumman Newport News Shipbuilding

(6) Food Processing Industry Cluster in Virginia

Adolph Coors Company
Anheuser Busch Companies
Birdsong Peanuts
Boar's Head Provisions
Cargill
Coca-Cola
Eastern Shore Seafood Products
Fiorucci Foods
Frito Lay
H.P. Hood
Hershey Foods
Iceland Seafood
Interbake Foods
Kraft Foods
Lipton Tea
Maple Leaf Bakery
Maruchan McKee Foods
Nestle USA
Pepsi Bottling Group
PepsiCo
Perdue
Farms Sara Lee Coffee and Tea
Smithfield Foods
Tyson Foods
Universal Food & Beverage

(7) Global Logistics Industry Cluster in Virginia

(8) Modeling & Simulation Industry Cluster in Virginia

(9) Plastics Industry Cluster in Virginia

Alcoa Flexible Packaging
Alloy Polymers, Inc.
BASFCP Films Inc.
Creative Urethanes
DanChem Technologies
Drake Extrusion, Inc.
DuPont
Teijin Films
Essel Propack America
Gala Industries
Glad
Goodyear Tire & Rubber Company
Graham Packaging Honeywell
Intertape Polymer Group
Klöckner Pentaplast of America
M&H Plastics
Melnor
Plastics One, Inc.
Polymer Group, Inc.
PolyOne
Printpack Inc.
Quadrant Engineering Plastics Products
Rubbermaid
Sartomer Company
Strongwell
Tessy
Tredegar Corporation
Yokohama Tire
Yupo Corporation

(10) Wood Products Industry Cluster in Virginia

WAGE INFORMATION FOR SELECTED FOREST-RELATED OCCUPATIONS IN VIRGINIA

Occupation	Average Hourly Wage
Cabinet Makers and Bench Carpenters	$14.41
Carpenters	$17.88
Cementing and Gluing Machine Operators & Tenders	$12.56
Coating, Painting, & Spraying Machine Setters, Operators, & Tenders	$13.98
First Line Supervisors of Production & Operations Workers	$25.48
Industrial Production Managers	$42.14
Inspectors, Testers, Sorters, Samplers, Weighers	$16.16
Logging Equipment Operators	$14.15
Machine Feeders and Offbearers	$10.51
Maintenance & Repair Workers	$16.78
Sawing Machine Setters, Operators & Tenders	$13.49
Woodworking Machine Setters, Operators, Tenders	$12.17

Industry clusters have also been defined for the Roanoke Valley and New River Valley by various constituencies. No additional data that might include specific businesses was available. Virginia Ally Information Exchange defined industry clusters for the Roanoke Valley as:

- Automotive Manufacturing
- Chemicals & Materials
- Communication & Entertainment
- Electronics Equipment & Instruments Manufacturing
- Finance and Insurance
- Health Care
- Information Technology & Professional Services
- Machinery & Equipment Manufacturing
- Wood Products & Furniture Manufacturing

The New River Valley Planning District defined industry clusters for the New River Valley. Again, no additional data was available.

- Automotive
- Contained Care
- Chemicals and Plastics
- High Tech
- Food Processing
- Health Services
- Furniture and Wood Products
- Textiles and Apparel

Location Quotients

In discussing industry clusters with Mr. John Hull, Roanoke Regional Economic Resource Planner, it became apparent that some refer to industry clusters rather loosely. He is currently gathering data from the Virginia Employment Commission and defining clusters by a location quotient (LQ) formula (http://www.ibrc.indiana.edu/innovation/interactive.asp). An LQ = 1 substantiates a developing cluster, and a heavily concentrated cluster is a LQ = 2 or more. When looking at the Roanoke and New River Valleys, this methodology severely limited the

information that this project was to generate. His data is as follows (Figure 19: Location Quotient by Cluster, Roanoke Valley-Allegheny Regional Commission CEDS Region, 2006):

Figure 19: Location Quotient by Cluster, RVARC CEDS Region, 2006

Cluster	Cluster Employment	LQ (VA COMPARISON)	LQ (US COMPARISON)
Electrical equip, appliance and component manufacturing subcluster	1,432	**4.161815176**	**2.940979894**
Glass and Ceramics	760	**4.710611395**	**2.062879342**
Forest and Wood Products	3,916	**1.606139032**	**1.807191369**
Motor Vehicle Manufacturing	3,175	**2.546384202**	**1.541191893**
Transportation and Logistics	6,559	**1.367981417**	**1.385750124**
Chemicals and Chemical-Based Products	3,663	**1.785271499**	**1.365080233**
Construction Sector	4,148	**0.988034105**	**1.285840067**
Primary metal Manufacturing Subcluster	622	**2.68242734**	**1.239003181**
Healthcare and Social Assistance Sector	22,823	**1.42807149**	**1.208503461**
Apparel and Textiles	1,638	**1.248685785**	**1.163958671**
Biomedical and Biotechnical Life Sciences	17,325	**1.410509546**	**1.152171766**
Retail Trade Sector	19,932	**1.066189695**	**1.085763989**
Fabricated metal product manufacturing subcluster	1,724	**1.984513965**	**1.010124862**
Advanced Materials	5,724	**1.395201709**	**0.932623482**
Defense and Security	7,260	**0.488448808**	**0.926785353**
Information Technology and Telecommunications	5,506	**0.553148115**	**0.917259674**
Transportation equipment manufacturing subcluster	1,705	**0.877435852**	**0.856239833**
Business and Financial Services	11,341	**0.610007648**	**0.853889986**
Energy (Fossil and Renewable)	5,621	**0.702169919**	**0.827277281**
Mining	181	**1.053714593**	**0.796287855**
Printing and Publishing	2,131	**0.892677383**	**0.77146194**
Arts, Entertainment, Recreation and Visitor Industries	3,734	**0.74330111**	**0.654659841**
Government and Public Administration Sector	5,210	**0.571557348**	**0.641184725**
Machinery manufacturing subcluster	785	**1.012510019**	**0.585925145**
Computer and electronic product manufacturing subcluster	820	**1.186763256**	**0.555730522**
Education and Knowledge Creaton	2,953	**0.581832551**	**0.54419025**
Agribusiness, Food Processing and Technology	1,102	**0.520338472**	**0.323989915**

Source: Virginia Employment Commission, QCEW, 2007.

Note that there are only four (4) industry clusters in the Virginia comparison column (ten with potential development) and two (2) in the U.S. comparison column (eleven with potential development) using the location quotient. This created a dilemma for the further development of this project. In discussions with Dr. McKeon and Ms. Kathryn Tisinger, Manager of the RHEC Career Center, a "cluster" list for the Roanoke and New River Valleys was generated and noted

as “sectors” rather than clusters. This was necessary due to the limitations of potential industry development as defined by various constituencies. By looking more to occupational development rather than industrial development, sectors seemed more logical for this project versus clusters (as defined by economic planning experts).

Roanoke Valley and New River Valley Industry Sectors With Potential Growth

The ten (10) industry sectors that were defined for this project include the following. Each of these has potential for growth in the Roanoke and/or the New River Valley regions.

1. Agriculture, Forestry and Fishing
    - Administrative
    - Technician
2. Biomedical
    - Research, product development and patents
    - Administrative/executive
3. Business, Finance and Insurance
    - CFO’s
    - Lenders
    - Claims personnel
    - Real estate
    - Computer technology
    - Administrative
4. Chemical, Mining, Construction, and Machine & Equipment Manufacturing
    - Administrative
    - Operations
5. Education
    - Classroom instruction PK-12
    - Higher education
    - Administration
6. Government and Public Administration
    - Public Safety: EMS, Fire, Police, Airport
7. Healthcare
    - Clinical
    - Non-clinical
8. Information Technology
    - Computer
    - Telecommunications
    - Customer service

9. Retail
    Sales
    Administration
10. Tourism
    Administration
    Customer service

These industries have been defined as sectors so as not to confuse them with clusters. It is from these sectors that this project was furthered. The matrix below indicates the present offerings in each sector at the Roanoke Higher Education Center.

Sector Potential/Institutional Development Matrix

School	**Sector**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Averett University	O	O	X	O	X	O	O	O	O	O
Bluefield College	O	O	X	O	O	X	X	O	O	O
Hampton University	O	O	X	O	O	X	O	O	O	O
Hollins University	O	O	O	O	X	O	O	O	O	O
James Madison University	O	O	O	O	X	X	O	O	O	O
Jefferson College of Health Sciences	O	O	O	O	O	O	X	O	O	O
Mary Baldwin College	O	O	X	O	X	X	X	O	O	O
Nova Southeastern University	O	O	O	O	X	O	O	O	O	O
Old Dominion University	O	O	O	O	X	O	O	O	O	O
Radford University	O	O	X	O	X	X	X	X	O	O
Roanoke College	O	O	O	O	O	O	O	O	O	O
TAP/This Valley Works	O	O	X	O	O	O	X	O	O	O
University of Virginia	O	O	X	O	X	O	X	X	O	O
Virginia Tech Roanoke Center	O	O	X	X	X	X	O	X	O	O

	Sector									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Virginia Western Community College	O	O	X	O	O	O	O	X	O	O
Western VA Workforce Development Board	O	O	O	O	O	O	O	O	O	O

****An 'X' in the sector column indicates it that applies to the member; 'O' indicates does not apply.**

O*NET

After developing usable sectors for this project, the next step was to understand what skills were needed for each sector. This will be useful in the future development of educational and training needs. O*NET, funded by the U.S. Department of Labor, was used in the development of skill matrices. A description of O*NET follows.

> The O*NET program is the nation's primary source of occupational information. Central to the project is the O*NET database, containing information on hundreds of standardized and occupation-specific descriptors. The database is continually updated by surveying a broad range of workers from each occupation. Information from this freely available database forms the heart of O*NET OnLine, the interactive application for exploring and searching occupations. The database also provides the basis for our Career Exploration Tools, a set of valuable assessment instruments for workers and students looking to find or change careers.
>
> Content Model: Anatomy of an occupation
>
> Every occupation requires a different mix of knowledge, skills, and abilities, and is performed using a variety of activities and tasks. These distinguishing characteristics of an occupation are described by the O*NET Content Model, which encapsulates the key features of an occupation into a standardized, measurable set of variables called "descriptors". The hierarchical model starts with six domains, describing the day-to-day aspects of the job and the qualifications and interests of the typical worker. The model expands to 277 descriptors collected by the O*NET program, with more collected by other federal agencies such as the Bureau of Labor Statistics.
>
> O*NET-SOC Taxonomy: A spectrum of occupations
>
> While the Content Model defines the information structure for a single occupation, the O*NET-SOC taxonomy defines the set of occupations across the world of work. Based on the Standard Occupational Classification, the O*NET-SOC taxonomy

currently includes 812 occupations which currently have, or are scheduled to have, data collected from job incumbents or occupation experts. To keep up with the changing occupational landscape, the taxonomy is periodically revised; the last revision was in 2006, with additional new and emerging occupations coming in a future update.

Data Collection: Real-world information

The O*NET-SOC taxonomy defines the occupations, and the Content Model outlines which information is collected; the Data Collection program brings these frameworks to life with results from the working public. The O*NET database was initially populated by a group of occupation analysts; this information is augmented by ongoing surveys of each occupation's worker population and occupation experts. These statistical results are incorporated into new versions of the database on an annual schedule, to provide up-to-date information on occupations as they evolve over time. The latest database releases are available from the Developer's Corner.

The Skills Matrix

To this point discussion has focused on the definition of industry clusters, industry clusters that exist in the Roanoke and New River Valleys, clusters (that were defined as sectors) that have potential for growth, and markets and jobs in the U.S. that are hot for 2008. The source for occupational information to address skills needed comes from O*NET as described above. The following skills matrix was developed from the O*NET site. It can be used to help identify skills needed for particular occupations (adapted from http://www.onetcenter.org/).

.RHEC Sector Skills Matrix Worksheet

Skill	**Sector**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
I. Basic Skills										
Developed capacities that facilitate learning or the more rapid acquisition of knowledge										
Active Learning:										
Active Listening:										
Critical Thinking:										
Learning Strategies:										
Mathematics:										
Monitoring:										
Reading Comprehension:										
Science:										
Speaking:										
Writing:										

Skill	**Sector**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

II. Complex Problem Solving Skills
Developed capacities used to solve novel, ill-defined problems in complex, real-world settings
Complex Problem Solving:

III. Resource Management Skills
Developed capacities used to allocate resources efficiently
Management of Financial Resources:
Management of Material Resources:
Management of Personnel Resources:
Time Management:

IV. Social Skills
Developed capacities used to work with people to achieve goals
Coordination:
Instructing:
Negotiation:
Persuasion:
Service Orientation:
Social Perceptiveness:

V. Systems Skills
Developed capacities used to understand, monitor, and improve socio-technical systems
Judgment and Decision Making:
Systems Analysis:
Systems Evaluation:

VI. Technical Skills
Developed capacities used to design, set-up, operate, and correct malfunctions involving application of machines or technological systems
Equipment Maintenance:
Equipment Selection:
Installation:
Operation and Control:
Operation Monitoring:
Operations Analysis:
Programming:
Quality Control Analysis:
Repairing:
Technology Design:
Troubleshooting:

The Skills Matrix Descriptions (for the RHEC Sector Skills Matrix)

Skill

I. Basic Skills

Developed capacities that facilitate learning or the more rapid acquisition of knowledge

Active Learning: Understanding the implications of new information for both current and future problem-solving and decision-making.

Active Listening: Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.

Critical Thinking: Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.

Learning Strategies: Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things.

Mathematics: Using mathematics to solve problems.

Monitoring: Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.

Reading Comprehension: Understanding written sentences and paragraphs in work related documents.

Science: Using scientific rules and methods to solve problems.

Speaking: Talking to others to convey information effectively.

Writing: Communicating effectively in writing as appropriate for the needs of the audience.

II. Complex Problem Solving Skills

Developed capacities used to solve novel, ill-defined problems in complex, real-world settings

Complex Problem Solving: Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.

III. Resource Management Skills

Developed capacities used to allocate resources efficiently

Management of Financial Resources: Determining how money will be spent to get the work done, and accounting for these expenditures.

Management of Material Resources: Obtaining and seeing to the appropriate use of equipment, facilities, and materials needed to do certain work.

Management of Personnel Resources: Motivating, developing, and directing people as they work, identifying the best people for the job.

Time Management: Managing one's own time and the time of others.

IV. Social Skills

Developed capacities used to work with people to achieve goals

Coordination: Adjusting actions in relation to others' actions.

Instructing: Teaching others how to do something.

Negotiation: Bringing others together and trying to reconcile differences.

Persuasion: Persuading others to change their minds or behavior.

Service Orientation: Actively looking for ways to help people.

Social Perceptiveness: Being aware of others' reactions and understanding why they react as they do.

V. Systems Skills

Developed capacities used to understand, monitor, and improve socio-technical systems

Judgment and Decision Making: Considering the relative costs and benefits of potential actions to choose the most appropriate one.

Systems Analysis: Determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes.

Systems Evaluation: Identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system.

VI. Technical Skills
Developed capacities used to design, set-up, operate, and correct malfunctions involving application of machines or technological systems
Equipment Maintenance: Performing routine maintenance on equipment and determining when and what kind of maintenance is needed.
Equipment Selection: Determining the kind of tools and equipment needed to do a job.
Installation: Installing equipment, machines, wiring, or programs to meet specifications.
Operation and Control: Controlling operations of equipment or systems.
Operation Monitoring: Watching gauges, dials, or other indicators to make sure a machine is working properly.
Operations Analysis: Analyzing needs and product requirements to create a design.
Programming: Writing computer programs for various purposes.
Quality Control Analysis: Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
Repairing: Repairing machines or systems using the needed tools.
Technology Design: Generating or adapting equipment and technology to serve user needs.
Troubleshooting: Determining causes of operating errors and deciding what to do about it.

The following skills matrix demonstrates skills needed for the ten (10) industry sectors identified for the Roanoke and New River Valleys.

RHEC Sector Skills Matrix Worksheet

Skill	**Sector**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
I. Basic Skills										
Developed capacities that facilitate learning or the more rapid acquisition of knowledge										
Active Learning:	X	X	X	X	X	X	X	X	O	O
Active Listening:	X	X	X	X	X	X	X	X	X	X
Critical Thinking:	X	X	X	X	X	X	X	X	X	X
Learning Strategies:	X	X	X	X	X	X	X	O	X	O
Mathematics:	X	X	X	O	X	O	X	X	O	O
Monitoring:	X	X	X	O	X	X	X	O	O	O
Reading Comprehension:	X	X	X	X	X	X	X	X	O	O
Science:	X	X	X	O	X	O	O	O	O	O
Speaking:	X	X	X	X	X	X	X	X	X	X
Writing:	X	X	X	O	X	X	X	X	X	X

	Sector									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
II. Complex Problem Solving Skills										
Developed capacities used to solve novel, ill-defined problems in complex, real-world settings										
Complex Problem Solving:	X	X	X	O	X	X	X	X	O	O
III. Resource Management Skills										
Developed capacities used to allocate resources efficiently										
Management of Financial Resources:	X	X	X	O	O	X	O	O	X	O
Management of Material Resources:	X	X	X	O	X	X	O	O	X	O
Management of Personnel Resources:	X	X	X	O	O	X	X	O	X	O
Time Management:	X	X	X	X	X	X	X	X	X	X
IV. Social Skills										
Developed capacities used to work with people to achieve goals										
Coordination:	X	X	X	X	X	X	X	X	X	X
Instructing:	O	X	X	O	X	X	X	X	X	X
Negotiation:	O	X	X	O	X	X	X	O	X	O
Persuasion:	O	X	X	O	X	X	X	O	X	X
Service Orientation:	X	X	X	O	X	X	X	X	X	X
Social Perceptiveness:	X	X	X	O	X	X	X	X	X	X
V. Systems Skills										
Developed capacities used to understand, monitor, and improve socio-technical systems										
Judgment and Decision Making:	X	X	X	X	X	X	X	X	X	O
Systems Analysis:	X	X	X	O	O	X	O	O	O	O
Systems Evaluation:	O	X	X	O	O	X	O	O	O	O
VI. Technical Skills										
Developed capacities used to design, set-up, operate, and correct malfunctions involving application of machines or technological systems										
Equipment Maintenance:	X	X	X	X	O	O	O	X	O	O
Equipment Selection:	X	X	X	X	O	O	O	X	X	O
Installation:	X	X	X	X	O	O	O	X	X	O
Operation and Control:	X	X	X	X	O	O	X	X	O	O
Operation Monitoring:	X	X	X	X	O	O	O	X	O	O

	Sector									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Operations Analysis:	O	X	X	X	O	O	O	X	O	O
Programming:	O	X	X	O	O	O	O	X	O	O
Quality Control Analysis:	O	X	X	O	O	O	O	X	O	O
Repairing:	X	X	X	O	O	O	O	X	O	O
Technology Design:	O	X	X	O	O	O	O	X	O	O
Troubleshooting:	X	X	X	X	X	O	X	X	X	X

Adapted from U.S. Department of Labor
http://www.onetcenter.org/

X = skill necessary
O = skill not necessary

High Growth Industries

With industry sectors defined and skills noted for those sectors, recognizing groups of occupations (Job Families) based upon work performed, skills, education, training, and credentials was constructed using O*NET (http://online.onetcenter.org/find/). National High Growth Industries are economically critical, projected to add substantial numbers of new jobs, and are being transformed by technology and innovation. Many occupations require education in science, technology, engineering, and mathematics (STEM) disciplines. These High Growth Industry Job Families are noted below for each of the ten (10) defined industry sectors for this project.

1. Farming, Fishing, and Forestry

Code	Occupation
45-2091.00	Agricultural Equipment Operators
45-2011.00	Agricultural Inspectors
45-2099.99	Agricultural Workers, All Other
45-2021.00	Animal Breeders
45-4021.00	Fallers
45-1012.00	Farm Labor Contractors
45-2092.02	Farm workers and Laborers, Crop

45-2092.00	Farm workers and Laborers, Crop, Nursery, and Greenhouse
45-2093.00	Farm workers, Farm and Ranch Animals
45-1011.07	First-Line Supervisors/Managers of Agricultural Crop and Horticultural Workers
45-1011.08	First-Line Supervisors/Managers of Animal Husbandry and Animal Care Workers
45-1011.06	First-Line Supervisors/Managers of Aquacultural Workers
45-1011.00	First-Line Supervisors/Managers of Farming, Fishing, and Forestry Workers
45-1011.05	First-Line Supervisors/Managers of Logging Workers
45-3011.00	Fishers and Related Fishing Workers
45-4011.00	Forest and Conservation Workers
45-2041.00	Graders and Sorters, Agricultural Products
45-3021.00	Hunters and Trappers
45-4023.00	Log Graders and Scalers
45-4022.00	Logging Equipment Operators
45-4029.99	Logging Workers, All Other
45-2092.01	Nursery Workers

2. Biotechnology

Projected Growth (2006-2016)	Projected Need (2006-2016)	Code	Occupation
Much faster than average	42000	19-2041.00	Environmental Scientists and Specialists, Including Health
Much faster than average	6000	17-2031.00	Biomedical Engineers
Faster than average	46000	29-2012.00	Medical and Clinical Laboratory Technicians
Faster than average	45000	19-1042.00	Medical Scientists, Except Epidemiologists
Faster than average	41000	19-4021.00	Biological Technicians
Faster than average	7000	19-1021.00	Biochemists and Biophysicists
Average	142000	41-4011.00	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
Average	46000	29-2011.00	Medical and Clinical Laboratory Technologists
Average	30000	19-2031.00	Chemists
Average	22000	17-3026.00	Industrial Engineering Technicians

Average	10000	17-2041.00	Chemical Engineers
Average	6000	19-1023.00	Zoologists and Wildlife Biologists
Average	6000	19-4011.00	Agricultural and Food Science Technicians
		19-4011.01	Agricultural Technicians
		19-4011.02	Food Science Technicians
Average	5000	19-1022.00	Microbiologists
Slower than average	24000	19-4031.00	Chemical Technicians
Decline slowly or moderately	23000	51-9023.00	Mixing and Blending Machine Setters, Operators, and Tenders
Decline slowly or moderately	10000	51-9012.00	Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders

3. Business and Financial Operations

Code	Occupation
13-2011.01	Accountants
13-2011.00	Accountants and Auditors
13-1011.00	Agents and Business Managers of Artists, Performers, and Athletes
13-2021.00	Appraisers and Assessors of Real Estate
13-2021.02	Appraisers, Real Estate
13-2021.01	Assessors
13-2011.02	Auditors
13-2031.00	Budget Analysts
13-1199.99	Business Operations Specialists, All Other
13-1031.00	Claims Adjusters, Examiners, and Investigators
13-1031.01	Claims Examiners, Property and Casualty Insurance
13-1072.00	Compensation, Benefits, and Job Analysis Specialists
13-1041.00	Compliance Officers, Except Agriculture, Construction, Health and Safety, and Transportation
13-1041.06	Coroners
13-1051.00	Cost Estimators
13-2041.00	Credit Analysts
13-1061.00	Emergency Management Specialists
13-1071.01	Employment Interviewers
13-1071.00	Employment, Recruitment, and Placement Specialists
13-1041.01	Environmental Compliance Inspectors
13-1041.03	Equal Opportunity Representatives and Officers
13-2051.00	Financial Analysts
13-2061.00	Financial Examiners
13-2099.99	Financial Specialists, All Other

13-1041.04	Government Property Inspectors and Investigators
13-1079.99	Human Resources, Training, and Labor Relations Specialists, All Other
13-1031.02	Insurance Adjusters, Examiners, and Investigators
13-1032.00	Insurance Appraisers, Auto Damage
13-2053.00	Insurance Underwriters
13-1041.02	Licensing Examiners and Inspectors
13-2071.00	Loan Counselors
13-2072.00	Loan Officers
13-1081.00	Logisticians
13-1111.00	Management Analysts
13-1121.00	Meeting and Convention Planners
13-2052.00	Personal Financial Advisors
13-1071.02	Personnel Recruiters
13-1021.00	Purchasing Agents and Buyers, Farm Products
13-1023.00	Purchasing Agents, Except Wholesale, Retail, and Farm Products
13-2081.00	Tax Examiners, Collectors, and Revenue Agents
13-2082.00	Tax Preparers
13-1073.00	Training and Development Specialists
13-1022.00	Wholesale and Retail Buyers, Except Farm Products

4. Construction and Extraction

Code	Occupation
47-2011.00	Boilermakers
47-2021.00	Brick masons and Block masons
47-2031.00	Carpenters
47-2041.00	Carpet Installers
47-2051.00	Cement Masons and Concrete Finishers
47-4011.00	Construction and Building Inspectors
47-4099.99	Construction and Related Workers, All Other
47-2031.01	Construction Carpenters
47-2061.00	Construction Laborers
47-5041.00	Continuous Mining Machine Operators
47-5011.00	Derrick Operators, Oil and Gas
47-2081.00	Drywall and Ceiling Tile Installers
47-5021.00	Earth Drillers, Except Oil and Gas
47-2111.00	Electricians
47-4021.00	Elevator Installers and Repairers
47-5031.00	Explosives Workers, Ordnance Handling Experts, and Blasters

47-5099.99	Extraction Workers, All Other
47-4031.00	Fence Erectors
47-1011.00	First-Line Supervisors/Managers of Construction Trades and Extraction Workers
47-2042.00	Floor Layers, Except Carpet, Wood, and Hard Tiles
47-2043.00	Floor Sanders and Finishers
47-2121.00	Glaziers
47-4041.00	Hazardous Materials Removal Workers
47-3019.99	Helpers, Construction Trades, All Other
47-3011.00	Helpers—Brick masons, Block masons, Stonemasons, and Tile and Marble Setters
47-3012.00	Helpers—Carpenters
47-3013.00	Helpers—Electricians
47-5081.00	Helpers--Extraction Workers
47-3014.00	Helpers--Painters, Paperhangers, Plasterers, and Stucco Masons
47-3015.00	Helpers—Pipe layers, Plumbers, Pipefitters, and Steamfitters
47-3016.00	Helpers—Roofers
47-4051.00	Highway Maintenance Workers
47-2131.00	Insulation Workers, Floor, Ceiling, and Wall
47-2132.00	Insulation Workers, Mechanical
47-5042.00	Mine Cutting and Channeling Machine Operators
47-5049.99	Mining Machine Operators, All Other
47-2073.00	Operating Engineers and Other Construction Equipment Operators
47-2141.00	Painters, Construction and Maintenance
47-2142.00	Paperhangers
47-2071.00	Paving, Surfacing, and Tamping Equipment Operators
47-2072.00	Pile-Driver Operators
47-2152.01	Pipe Fitters and Steamfitters
47-2151.00	Pipe layers
47-2161.00	Plasterers and Stucco Masons
47-2152.02	Plumbers
47-2152.00	Plumbers, Pipefitters, and Steamfitters
47-4061.00	Rail-Track Laying and Maintenance Equipment Operators
47-2171.00	Reinforcing Iron and Rebar Workers
47-5051.00	Rock Splitters, Quarry
47-5061.00	Roof Bolters, Mining
47-2181.00	Roofers
47-5012.00	Rotary Drill Operators, Oil and Gas
47-2031.02	Rough Carpenters
47-5071.00	Roustabouts, Oil and Gas

47-4091.00	Segmental Pavers
47-4071.00	Septic Tank Servicers and Sewer Pipe Cleaners
47-5013.00	Service Unit Operators, Oil, Gas, and Mining
47-2211.00	Sheet Metal Workers
47-2022.00	Stonemasons
47-2221.00	Structural Iron and Steel Workers
47-2082.00	Tapers
47-2053.00	Terrazzo Workers and Finishers
47-2044.00	Tile and Marble Setters

5. Education, Training, and Library

Code	Occupation
25-3011.00	Adult Literacy, Remedial Education, and GED Teachers and Instructors
25-1041.00	Agricultural Sciences Teachers, Postsecondary
25-1061.00	Anthropology and Archeology Teachers, Postsecondary
25-1031.00	Architecture Teachers, Postsecondary
25-4011.00	Archivists
25-1062.00	Area, Ethnic, and Cultural Studies Teachers, Postsecondary
25-1121.00	Art, Drama, and Music Teachers, Postsecondary
25-1051.00	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary
25-9011.00	Audio-Visual Collections Specialists
25-1042.00	Biological Science Teachers, Postsecondary
25-1011.00	Business Teachers, Postsecondary
25-1052.00	Chemistry Teachers, Postsecondary
25-1122.00	Communications Teachers, Postsecondary
25-1021.00	Computer Science Teachers, Postsecondary
25-1111.00	Criminal Justice and Law Enforcement Teachers, Postsecondary
25-4012.00	Curators
25-1063.00	Economics Teachers, Postsecondary
25-1081.00	Education Teachers, Postsecondary
25-9099.99	Education, Training, and Library Workers, All Other
25-2021.00	Elementary School Teachers, Except Special Education
25-1032.00	Engineering Teachers, Postsecondary
25-1123.00	English Language and Literature Teachers, Postsecondary
25-1053.00	Environmental Science Teachers, Postsecondary
25-9021.00	Farm and Home Management Advisors
25-1124.00	Foreign Language and Literature Teachers, Postsecondary

25-1043.00	Forestry and Conservation Science Teachers, Postsecondary
25-1064.00	Geography Teachers, Postsecondary
25-1191.00	Graduate Teaching Assistants
25-1071.00	Health Specialties Teachers, Postsecondary
25-1125.00	History Teachers, Postsecondary
25-1192.00	Home Economics Teachers, Postsecondary
25-9031.00	Instructional Coordinators
25-2012.00	Kindergarten Teachers, Except Special Education
25-1112.00	Law Teachers, Postsecondary
25-4021.00	Librarians
25-1082.00	Library Science Teachers, Postsecondary
25-4031.00	Library Technicians
25-1022.00	Mathematical Science Teachers, Postsecondary
25-2022.00	Middle School Teachers, Except Special and Vocational Education
25-4013.00	Museum Technicians and Conservators
25-1072.00	Nursing Instructors and Teachers, Postsecondary
25-1126.00	Philosophy and Religion Teachers, Postsecondary
25-1054.00	Physics Teachers, Postsecondary
25-1065.00	Political Science Teachers, Postsecondary
25-1199.99	Postsecondary Teachers, All Other
25-2011.00	Preschool Teachers, Except Special Education
25-1066.00	Psychology Teachers, Postsecondary
25-1193.00	Recreation and Fitness Studies Teachers, Postsecondary
25-2031.00	Secondary School Teachers, Except Special and Vocational Education
25-3021.00	Self-Enrichment Education Teachers
25-1069.99	Social Sciences Teachers, Postsecondary, All Other
25-1113.00	Social Work Teachers, Postsecondary
25-1067.00	Sociology Teachers, Postsecondary
25-2042.00	Special Education Teachers, Middle School
25-2041.00	Special Education Teachers, Preschool, Kindergarten, and Elementary School
25-2043.00	Special Education Teachers, Secondary School
25-9041.00	Teacher Assistants
25-3099.99	Teachers and Instructors, All Other
25-2023.00	Vocational Education Teachers, Middle School
25-1194.00	Vocational Education Teachers, Postsecondary
25-2032.00	Vocational Education Teachers, Secondary School

6. Management

Code	Occupation
11-3011.00	Administrative Services Managers
11-2011.00	Advertising and Promotions Managers
11-9011.03	Aquacultural Managers
11-1011.00	Chief Executives
11-3041.00	Compensation and Benefits Managers
11-3021.00	Computer and Information Systems Managers
11-9021.00	Construction Managers
11-9011.02	Crop and Livestock Managers
11-9039.99	Education Administrators, All Other
11-9032.00	Education Administrators, Elementary and Secondary School
11-9033.00	Education Administrators, Postsecondary
11-9031.00	Education Administrators, Preschool and Child Care Center/Program
11-9041.00	Engineering Managers
11-9011.00	Farm, Ranch, and Other Agricultural Managers
11-9012.00	Farmers and Ranchers
11-3031.00	Financial Managers
11-3031.02	Financial Managers, Branch or Department
11-9051.00	Food Service Managers
11-9061.00	Funeral Directors
11-9071.00	Gaming Managers
11-1021.00	General and Operations Managers
11-3040.00	Human Resources Managers
11-3049.99	Human Resources Managers, All Other
11-3051.00	Industrial Production Managers
11-1031.00	Legislators
11-9081.00	Lodging Managers
11-9199.99	Managers, All Other
11-2021.00	Marketing Managers
11-9111.00	Medical and Health Services Managers
11-9121.00	Natural Sciences Managers
11-9011.01	Nursery and Greenhouse Managers
11-9131.00	Postmasters and Mail Superintendents
11-9141.00	Property, Real Estate, and Community Association Managers
11-2031.00	Public Relations Managers
11-3061.00	Purchasing Managers
11-2022.00	Sales Managers
11-9151.00	Social and Community Service Managers

11-3071.02	Storage and Distribution Managers
11-3042.00	Training and Development Managers
11-3071.01	Transportation Managers
11-3071.00	Transportation, Storage, and Distribution Managers
11-3031.01	Treasurers and Controllers

7A. Healthcare Practitioners and Technical

Code	Occupation
29-1061.00	Anesthesiologists
29-9091.00	Athletic Trainers
29-1121.00	Audiologists
29-2031.00	Cardiovascular Technologists and Technicians
29-1011.00	Chiropractors
29-2021.00	Dental Hygienists
29-1029.99	Dentists, All Other Specialists
29-1021.00	Dentists, General
29-2032.00	Diagnostic Medical Sonographers
29-2051.00	Dietetic Technicians
29-1031.00	Dietitians and Nutritionists
29-2041.00	Emergency Medical Technicians and Paramedics
29-1062.00	Family and General Practitioners
29-1199.99	Health Diagnosing and Treating Practitioners, All Other
29-2099.99	Health Technologists and Technicians, All Other
29-9099.99	Healthcare Practitioners and Technical Workers, All Other
29-1063.00	Internists, General
29-2061.00	Licensed Practical and Licensed Vocational Nurses
29-2012.00	Medical and Clinical Laboratory Technicians
29-2011.00	Medical and Clinical Laboratory Technologists
29-2071.00	Medical Records and Health Information Technicians
29-2033.00	Nuclear Medicine Technologists
29-1064.00	Obstetricians and Gynecologists
29-9011.00	Occupational Health and Safety Specialists
29-9012.00	Occupational Health and Safety Technicians
29-1122.00	Occupational Therapists
29-2081.00	Opticians, Dispensing
29-1041.00	Optometrists
29-1022.00	Oral and Maxillofacial Surgeons
29-1023.00	Orthodontists
29-2091.00	Orthotists and Prosthetists
29-1065.00	Pediatricians, General
29-1051.00	Pharmacists

29-2052.00	Pharmacy Technicians
29-1123.00	Physical Therapists
29-1071.00	Physician Assistants
29-1069.99	Physicians and Surgeons, All Other
29-1081.00	Podiatrists
29-1024.00	Prosthodontists
29-2053.00	Psychiatric Technicians
29-1066.00	Psychiatrists
29-1124.00	Radiation Therapists
29-2034.02	Radiologic Technicians
29-2034.01	Radiologic Technologists
29-2034.00	Radiologic Technologists and Technicians
29-1125.00	Recreational Therapists
29-1111.00	Registered Nurses
29-1126.00	Respiratory Therapists
29-2054.00	Respiratory Therapy Technicians
29-1127.00	Speech-Language Pathologists
29-1067.00	Surgeons
29-2055.00	Surgical Technologists
29-1129.99	Therapists, All Other
29-1131.00	Veterinarians
29-2056.00	Veterinary Technologists and Technicians

7B. Healthcare Support

Code	Occupation
31-9091.00	Dental Assistants
31-9099.99	Healthcare Support Workers, All Other
31-1011.00	Home Health Aides
31-9011.00	Massage Therapists
31-9092.00	Medical Assistants
31-9093.00	Medical Equipment Preparers
31-9094.00	Medical Transcriptionists
31-1012.00	Nursing Aides, Orderlies, and Attendants
31-2012.00	Occupational Therapist Aides
31-2011.00	Occupational Therapist Assistants
31-9095.00	Pharmacy Aides
31-2022.00	Physical Therapist Aides
31-2021.00	Physical Therapist Assistants
31-1013.00	Psychiatric Aides
31-9096.00	Veterinary Assistants and Laboratory Animal Caretakers

8. Information Technology

Projected Growth (2006-2016)	Projected Need (2006-2016)	Code	Occupation
Much faster than average	300000	15-1031.00	Computer Software Engineers, Applications
Much faster than average	280000	15-1051.00	Computer Systems Analysts
Much faster than average	193000	15-1081.00	Network Systems and Data Communications Analysts
Much faster than average	154000	15-1071.00	Network and Computer Systems Administrators
		15-1071.01	Computer Security Specialists
Much faster than average	150000	15-1032.00	Computer Software Engineers, Systems Software
Much faster than average	47000	15-1061.00	Database Administrators
Much faster than average	12000	15-1011.00	Computer and Information Scientists, Research
Faster than average	86000	11-3021.00	Computer and Information Systems Managers
Average	242000	15-1041.00	Computer Support Specialists
Average	26000	41-9031.00	Sales Engineers
Slower than average	58000	17-2141.00	Mechanical Engineers
Slower than average	28000	17-2061.00	Computer Hardware Engineers
Decline slowly or moderately	91000	15-1021.00	Computer Programmers

9. Retail

Projected Growth (2006-2016)	Projected Need (2006-2016)	Code	Occupation
Much faster than average	1158000	43-4051.00	Customer Service Representatives
Much faster than average	291000	41-2021.00	Counter and Rental Clerks
Faster than average	63000	19-3021.00	Market Research Analysts

Faster than average	61000	11-2021.00	Marketing Managers
Faster than average	49000	41-9011.00	Demonstrators and Product Promoters
Faster than average	6000	19-3022.00	Survey Researchers
Average	1935000	41-2031.00	Retail Salespersons
Average	476000	41-4012.00	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products
Average	142000	41-4011.00	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
Average	103000	11-2022.00	Sales Managers
Average	32000	27-1026.00	Merchandise Displayers and Window Trimmers
Average	26000	41-9031.00	Sales Engineers
Slower than average	423000	41-1011.00	First-Line Supervisors/Managers of Retail Sales Workers
Slower than average	22000	11-3061.00	Purchasing Managers
Slower than average	13000	11-2011.00	Advertising and Promotions Managers
Little or no change	35000	13-1022.00	Wholesale and Retail Buyers, Except Farm Products
Decline slowly or moderately	1664000	41-2011.00	Cashiers
Decline slowly or moderately	79000	53-3031.00	Driver/Sales Workers
Decline rapidly	102000	53-7064.00	Packers and Packagers, Hand

10. Hospitality

Projected Growth (2006-2016)	Projected Need (2006-2016)	Code	Occupation
Much faster than average	291000	41-2021.00	Counter and Rental Clerks
Much faster than average	14000	39-1011.00	Gaming Supervisors
Much faster than average	14000	39-3093.00	Locker Room, Coatroom, and Dressing Room Attendants
Faster than average	927000	35-3021.00	Combined Food Preparation and Serving Workers, Including Fast Food

Faster than average	451000	35-2021.00	Food Preparation Workers
Faster than average	127000	43-4081.00	Hotel, Motel, and Resort Desk Clerks
Faster than average	59000	35-3041.00	Food Servers, Non-restaurant
Faster than average	37000	31-9011.00	Massage Therapists
Faster than average	20000	13-1121.00	Meeting and Convention Planners
Average	1537000	35-3031.00	Waiters and Waitresses
Average	463000	37-2012.00	Maids and Housekeeping Cleaners
Average	424000	35-3022.00	Counter Attendants, Cafeteria, Food Concession, and Coffee Shop
Average	328000	35-2014.00	Cooks, Restaurant
Average	277000	35-9031.00	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop
Average	265000	35-9021.00	Dishwashers
Average	236000	35-3011.00	Bartenders
Average	223000	35-9011.00	Dining Room and Cafeteria Attendants and Bartender Helpers
Average	223000	35-2011.00	Cooks, Fast Food
Average	154000	35-1012.00	First-Line Supervisors/Managers of Food Preparation and Serving Workers
Average	152000	35-2012.00	Cooks, Institution and Cafeteria
Average	77000	37-1011.00	First-Line Supervisors/Managers of Housekeeping and Janitorial Workers
Average	24000	11-9081.00	Lodging Managers
Average	23000	35-1011.00	Chefs and Head Cooks
Average	15000	41-2012.00	Gaming Change Persons and Booth Cashiers
Average	11000	39-6011.00	Baggage Porters and Bellhops
Average	7000	43-3041.00	Gaming Cage Workers
Slower than average	100000	11-9051.00	Food Service Managers
Slower than average	62000	35-2015.00	Cooks, Short Order
Decline slowly or moderately	17000	51-3093.00	Food Cooking Machine Operators and Tenders

RV and NRV Industry Sector Database

A considerable effort was put into building a database of entities in the ten (10) defined sectors. Ms. Carla James-Collins, Director of Academic and Student Services, and her staff are continually entering new industries/companies into the database which is located at http://www.education.edu/ on the secured sever at the link \\Wmata\library\RVandNRVIndustrySectorDatabase.xls. Data collected for each entry of each sector includes the following:

- Company
- Street Address
- City
- State
- Zip
- RV/NRV
- Contact: First Name
- Contact: Last Name
- Title
- Phone
- Email
- Website
- # of Employees
- Company Description

Data can be sorted and used for personal contacts, telephone solicitation, general mailings, e-mailings, etc. The database can be easily updated and used in a variety of programs including, for example, MS MailMerge. A current database is included in the Appendix of this paper.

Future Study Development

The final piece to this project at the Roanoke Higher Education Center is to recommend best methods or practices to assess training and educational needs. The needs have been defined by the ten (10) industry sectors noted earlier in this study. Future study development is divided into the '3M' areas: media, marketing, and members. Recommendations are as follows.

Media Recommendations

The media today drives many industries. Included is the industry of training and education. We see continuous advertising for skills in the United States military, programs at private educational institutions such as the University of Phoenix, and many college and university flagship activities on "game day" throughout the academic year. A campaign to advertise and promote the fundamental purpose of the Roanoke Higher Education Center, noting its' historic value and "green" design, would heighten awareness to the public as to the extent and possibility of future activity at the Center.

The *Continuum*, a magazine of current class offerings, serves as a promotion piece for the RHEC, and coincides with other such class schedule newspaper inserts. An advancement of that magazine would be to create a yearly magazine to be published in, for example the *Roanoke Times*, highlighting RHEC achievements for the year. The present Virginia Western Community College culinary program, Lincoln Theater addition, and James Madison University Master's in Public Administration program name just a few achievements for 2007-2008.

Marketing Recommendations

The Roanoke Higher Education Center is really a gem in the City of Roanoke. It meets a need for training and educational space under one roof (classrooms, computer laboratories, library, café, theater/auditorium, etc.). Keeping average citizens as well as political leaders aware of activities at the RHEC will only help to grow future business. Just who really knows and understands what the RHEC has to offer would be an interesting preliminary survey in order to begin a marketing campaign. To that end, several thoughts come to mind to increase awareness:

- Continue to offer 'Open Houses' by building relationships with schools and businesses, and invite them to the RHEC periodically. A program could be

coordinated that demonstrates the usefulness of the RHEC facility (e.g., a group uses the computer lab and an instructor discusses a particular computer program, or a group gets a lesson on preparing a dinner dish at the culinary kitchen).

- Create a speaker series where a 'select' group of juniors and seniors, homeschoolers, churches, business leaders, etc., are invited to the RHEC. The featured speaker would close the program with a tour of the RHEC, including receipt of a package of member materials for future reference. This could be an early morning, lunchtime, or evening event.

- Ten (10) sectors have been identified in this project. A sector could be featured each month (excluding July and December) at the RHEC by coordinating a program and/or event. Guests could be invited or be open to the public. This could be a published program in the *Continuum* and in the yearly magazine.

- A survey can have many purposes. Simple survey research can be done from an office computer through on-line vendors such as Survey Monkey. Costs are minimal from $19.95 per month to $200.00 per year for unlimited access to the vendor. This project developed a database of industry sectors, and from that database an email list can be generated and surveys executed. The surveys would focus on training and educational needs that support the RHEC and its members.

Member Recommendations

The members are the key to the survival of the Roanoke Higher Education Center. Supporting and keeping the members aware of the present and future benefits of the RHEC ensures a continuous revenue stream. It also ensures a high quality learning experience for those who come to the RHEC. As a RHEC partner institution faculty member at Jefferson College of Health Sciences and author of this project, I have never heard a negative word about the RHEC. High quality speaks for itself.

Two areas are noted for consideration. First, all members should have a direct link to the RHEC on their website in order to make it rather easy to transition to specific programs and courses offered at the RHEC. There should also be appropriate reverse linkages to the member institution as well on the RHEC website. This is not presently possible in all cases. And second, the RHEC should support the members in activities associated with campus visits at events such

as college fairs. This demonstrates good, simple supportive business practice where the RHEC benefits by helping to ensure easy access to courses and programs in downtown Roanoke.

Conclusion

And finally, to bring this project to a close is the conclusion to an article in *The Heinz School Review* on April 15, 2005, titled "Aligning Universities and Industry Clusters." It is an appropriate ending to this project and speaks to the importance of the contributions of the RHEC to the Roanoke and New River Valleys.

> Universities can play a powerful role in the development of industry clusters. There are many examples of how new industries form from university research. Similarly, new industry clusters have re-ordered the ranking of major economic regions. Unfortunately the path from university research to cluster development and finally to regional economic benefit is not simple or direct. The assets of the university must be properly aligned with clusters that are appropriate targets for the regional economy. This report concludes that the characteristics of the cluster are as important if not more important than the characteristics of the university. ***The task for the university (and for regional stakeholders) is to identify and support areas of university expertise that align with clusters of opportunity for the region.***

As is noted, the role of the university is to "identify and support" the emerging clusters. So it is true for the RHEC… identify and support those who offer programs and award degrees in areas of economic opportunity for the Roanoke and New River Valleys.

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Appendix

(1) Hot Markets and Jobs for 2008

The following list from *The Sun's Financial Diary* notes the 15 hottest markets and jobs in the U.S. for 2008, and includes the two-year job growth forecast.

1. Orlando, FL — 2-year job-growth forecast: 6.8%

- Senior mechanical engineer: $80,400
- Physician's assistant: $76,000
- IT project manager: $75,200
- Construction project manager: $71,200
- Electrical engineer: $64,900

2. Las Vegas, NV — 2-year job-growth forecast: 6.5%

- Construction project manager: $78,800
- IT project manager: $74,600
- Construction superintendent: $71,900
- Civil engineer: $70,000
- Executive chef: $65,500

3. Raleigh, NC — 2-year job-growth forecast: 5.8%

- Senior software developer: $91,000
- Software project manager: $87,300
- Senior network engineer: $84,100
- IT project manager: $83,300
- Pharmaceuticals project manager: $82,300
- Biotech research scientist: $75,300

4. Charlotte, NC — 2-year job-growth forecast: 5.7%

- IT project manager: $83,000
- Senior software developer: $82,900
- Regional sales manager: $80,500
- Senior financial analyst: $72,900
- Construction project manager: $71,200

5. Phoenix, AZ — 2-year job-growth forecast: 5.6%

- Senior software developer: $84,800
- IT project manager: $78,600
- Semiconductor process engineer: $78,000
- Physician's assistant: $76,200
- Construction project manager: $74,000

6. West Palm Beach, FL — 2-year job-growth forecast: 5.4%

- Senior software developer: $86,100
- Senior mechanical engineer: $81,800
- IT project manager: $80,400
- Construction project manager: $73,200
- Construction superintendent: $73,000

7. Tampa, FL — 2-year job-growth forecast: 5.3%

- Senior software developer: $80,900
- Senior IT systems engineer: $75,500
- IT project manager: $75,000
- Nurse practitioner: $70,200
- Construction project manager: $67,400

8. Riverside, CA — 2-year job-growth forecast: 5.2%

- Physician's assistant: $78,800
- Construction project manager: $77,600
- Manufacturing plant manager: $77,200
- Construction superintendent: $75,800
- Construction estimator: $68,600

9. Austin, TX — 2-year job-growth forecast: 4.9%

- Senior software engineer: $97,800
- Senior electronics design engineer: $97,500
- Senior software developer: $92,700
- Computer hardware engineer: $83,600
- Semiconductor process engineer: $81,600

10. Atlanta, GA — 2-year job-growth forecast: 4.6%

- Regional sales manager: $86,400
- Senior software developer: $84,900
- IT project manager: $83,000)
- Business process/management consultant: $76,500
- Senior financial analyst: $72,100
- Construction project manager: $70,300

11. Salt Lake City, UT — 2-year job-growth forecast: 4.4%

- Senior software developer: $81,600
- Electrical engineer: $73,800
- IT project manager: $69,200
- Financial controller: $67,200
- Construction project manager: $65,800

12. Jacksonville, FL — 2-year job-growth forecast: 4.4%

- IT project manager: $79,400
- Senior software developer: $77,800
- Financial controller: $76,800
- Physician's assistant: $75,900
- Construction project manager: $74,600

13. Dallas, TX — 2-year job-growth forecast: 4.2%

- Senior software developer: $88,500
- Operations director: $84,800
- IT project manager: $84,500
- Regional sales manager: $84,300
- Financial controller: $83,200

14. San Antonio, TX –2-year job-growth forecast: 4.2%

- Senior software developer: $83,900
- Physician's assistant: $78,400
- IT project manager: $76,800
- Human resources director: $75,800
- Construction project manager: $66,300

15. Fort Lauderdale, FL — 2-year job-growth forecast: 4.1%

- Senior software developer: $84,600
- Financial controller: $78,600
- IT project manager: $75,700
- HR director: $73,500
- Construction project manager: $72,700

(2) RV and NRV Industry Sector Database (dated 5/1/2008)