6. Career Pathway Clusters

The previous chapters presented the employment situation in the tri-state region, as well as the occupations that are in demand today and those with the brightest prospects for the future. The question then becomes, how does one transition to the occupations with the brightest prospects? How can a dislocated worker plot a path to a new job that uses the skill set he or she has developed other the years?[28] The career pathway cluster tool presented in this chapter is the first step in addressing these questions.

There are three key elements in this chapter. First, the technique used to group occupations into pathway clusters is groundbreaking. Pathway clusters are "a first" because they are not organized based upon industries (such as health care) or functions (like business administration). Second, while auto occupations are concentrated in the production, construction and engineering cluster, there are dozens of occupations in other industries that may make good target occupations for a displaced worker. Third, green occupations are well distributed throughout the clusters, except for the health, social and personal services cluster.

6.1 What Are Career Pathway Clusters?

The operating principle for the pathway cluster concept is that workers will seek, and be most productive in, occupations that are most similar to their current or former jobs. Based on O*NET's occupation description categories,[29] occupations are grouped into a pathway cluster based on similarities in worker requirements, worker traits and occupational requirements.[30] Because pathway clusters are constructed based on occupational and worker similarities, transitions from one pathway cluster to a different cluster would be relatively more difficult.

Advantages of pathway clusters over other career transition resources is that the user is provided a set of many possible target occupations, rather than one at a time. Combined with the skill-gap analysis (in the next chapter), a worker in transition can judge the relative ease and training required to move from one occupation to another. Also, the pathway cluster approach uses all occupation description categories of O*NET and not just a subset.

In order to create pathway clusters, the research team analyzed around 500 dimensions and characteristics for each occupation as published by O*NET. The research team compressed these into three O*NET-type[31] categories to develop pathway clusters:

> *"Workers will seek, and be most productive in, occupations that are most similar to their current or former jobs."*

[28] Except for references to O*NET skills, "skill set" is defined in the broad sense. It is shorthand for all the requirements for an occupation.

[29] Data for this analysis come from the Occupational Information Network—O*NET—which is supported by the U.S. Department of Labor's Employment and Training Administration. More information is available at http://www.onetcenter.org/overview.html. This analysis does not use the new 2010 SOC system because, at the time of the analysis, O*NET data were still based on the 2000 SOC system.

[30] This operating principle is similar to the TORQ system, which is a powerful tool that provides a compatibility score for comparing one occupation with another (http://www.torqworks.com/products). The TORQ system pulls in every detailed aspect that define the knowledge, skills and abilities (KSAs) of an occupation to determine whether two occupations are a good match. However, the pathway cluster approach uses all occupation description categories of O*NET (of which KSAs are a subset).

[31] Not all terms are directly taken from O*NET; many O*NET terms have been translated to appeal to a general audience. Occupational interests, for example, are based on the system developed by John L. Holland for matching vocational roles with personality types. For complete information, see John. L. Holland, *Making Vocational Choices: A Theory of Vocational Personalities and Work Environments* (Odessa, FL: Psychological Assessment Resources, 1997). For more information about this and other aspects of the methodology, please see http://www.drivingworkforcechange.org/reports/careerpathways.pdf.

1. ***Requirements of the worker (R):*** Worker requirements that can be gained by the worker through study or training

    - *Knowledge:* Sets of principles and facts in a subject area (aka knowledge requirement)
    - *Cross-Functional Skills:* The capacity to perform the activities across different jobs

2. ***Traits of the worker (T):*** The internal or personal traits of workers who are drawn to—or perform well in—the occupation

    - *Interests:* Preferences for the type of work and work environment based on personality types
    - *Work Values:* Work duties, outcomes and environment that are personally satisfying
    - *Work Styles:* Personal characteristics that influence performance

3. ***Occupational requirements (O):*** The requirements for the job, such as work activities (e.g., lifting heavy objects or gathering data)

    - *Generalized Work Activities:* Type and intensity of personal interactions and mental processes like problem solving and information gathering
    - *Work Context:* Physical activities and social factors that influence the nature of work

The research team analyzed three aspects of O*NET variables—correlation, spread and skew—to simplify and compress the O*NET occupation characteristics into a small number of intuitive and meaningful occupation pathway clusters that can best differentiate occupations. Compressing the O*NET data—removing characteristics that overlap and realigning the remaining occupation characteristics—means that pathway cluster definitions will not be one-to-one with O*NET, but the general thrust of the O*NET method remains intact.

The research team grouped the 2009 vintage of O*NET occupations into clusters by comparing the level of similarity (or dissimilarity) across occupations to form patterns. Cluster formation, which depends heavily on statistics and mathematical analysis, should create intuitive patterns, for example, placing engineering and physics in close proximity. If the clusters were not intuitive, the iterative process of forming and evaluating multiple sets of clusters started over again until all occupations were grouped into clusters that account for their similarities in worker requirements, worker traits and occupational requirements.

6.2 The Seven Pathway Clusters

Table 16 shows how the 731 occupations were grouped among seven pathway clusters. Occupations were fairly evenly divided among these seven clusters, except for the particularly large production, construction and engineering "super cluster." This cluster was further subdivided into 1) engineering and applied technology, 2) construction and extraction, equipment operation, and repair, and 3) design and production.

It is not surprising that the concentration of auto occupations in the production, construction and engineering cluster is high. For autoworkers looking for work within their cluster, it should be encouraging to know that they have options outside auto; 80 percent of the occupations in that super cluster are not distinctively in auto manufacturing.

As **Table 16** shows, green occupations are fairly well distributed across clusters, with the exception of the health, social and personal services cluster. Any worker, auto or otherwise, interested in making a transition to a green occupation would likely have several green target occupations within their cluster for which they have a relatively similar skill set and worker traits.

Below is a brief summary of each of the pathway clusters that highlights some of the key worker

requirements, (***R***) worker traits (***T***) and occupational requirements (***O***) that define each cluster. Discussion of the production, construction and engineering cluster highlights several key characteristics that form the cluster and provides some example occupations since that cluster includes the preponderance of automotive occupations. While at first glance the similarities among many of these occupations may not be obvious, the pattern of high scores among the key characteristics defining each particular cluster explains their fit within each group.

Table 16: Summary of Career Pathway Clusters

Cluster Name[§]	Number of Occupations	Number of Auto[*]	Number of Green[¤]
Information and Investigation	62	0	12
Health, Social and Personal Services	90	0	0
Production, Construction and Engineering	217	44	55
Engineering and Applied Technology	75	20	26
Construction and Extraction, Equipment Operation, and Repair	69	2	15
Design and Production	73	20	14
Liberal Arts, Education and Human Relations	86	0	7
Business, Sales and Administration	105	2	15
Transportation and Public Services	97	0	20
Environmental Sciences and Food Service	74	1	15

[§] Clusters are ordered based on their relative strength, or how "tight" the clusters are. Information and investigation was the strongest cluster. The environmental sciences and food service cluster, in contrast, had the weakest similarity scores. The number of occupations in a cluster does not speak to the cluster's relative strength or importance.

[*] Based on the CAR definition of auto-related occupations. It does not include two residual occupation categories "all other" for which there are no job specific data.

[¤] Based on the six-digit SOC definitions of the 2009 vintage of O*NET. The 2010 eight-digit O*NET/SOC definitions have considerably more jobs classified as green.

Source: Indiana Department of Workforce Development (IDWD) and the Indiana Business Research Center (IBRC)

The discussions for the other six clusters are shorter in the interest of brevity, not because they are any less important. The detailed report, available at www.drivingworkforcechange.org/reports/careerpathways.pdf, describes all the clusters in greater detail.

6.2.1 Information and Investigation

Despite cutting across several worker or occupation requirements and many different types of professions, the occupations in this cluster share strong similarities. Across a range of subject areas, these occupations involve collecting and analyzing data. These occupations also share many subject areas, including knowledge in computers, electronics and mathematics. Workers also need elevated capabilities in systems and programming, and they share personal characteristics such as working independently and having a great attention to detail. Workers drawn to these occupations are also personally interested in working with ideas, searching for facts and solving problems.

6.2.2 Health, Social and Personal Services

This might be called the "helping cluster." Two key occupational requirements define this cluster: assisting and caring for others and dealing with unpleasant, angry or physically aggressive people. Workers need knowledge in fields such as medicine and dentistry, psychology, and therapy and counseling. Workers are also characterized by higher levels of social interaction at work and having concern for others and self control. Workers also value building relationships and tend to be drawn to vocations in teaching, networking and communicating. Occupations such as medical doctors, therapists and nursing instructors fit this cluster.

6.2.3 Production, Construction and Engineering

This super cluster covers a wide range of worker and job characteristics. It is also the cluster with the most manufacturing and auto sector occupations. Similarity of the occupations within this cluster is relatively high compared to the other pathway clusters. This super cluster is dominated by occupations with high scores in six knowledge groups: mechanical; engineering and technology; design; physics; building and

Table 17: Engineering and Applied Technology Sub-Cluster: Key Occupation Factors

Category	Variable Type	Detailed Variable
R	Knowledge	Engineering and Technology
R	Knowledge	Mechanical
R	Knowledge	Physics
R	Skills	Monitoring/Design*
R	Skills	Systems/Programming*

*This measure represents a combination of several O*NET variables
Source: IDWD and IBRC, using O*NET data

Sample Occupations

- Electrical Engineers
- Electronics Engineers, Except Computer
- Mechanical Engineers
- Elevator Installers and Repairers
- Radio Mechanics
- Power Distributors and Dispatchers

Table 18: Construction and Extraction, Equipment Operation and Repair Sub-Cluster: Key Occupation Factors

Category	Variable Type	Detailed Variable
R	Knowledge	Building and Construction
R	Knowledge	Chemistry
R	Knowledge	Public Safety and Security
R	Knowledge	Transportation
O	Work Activities	Equipment*

*This measure represents a combination of several O*NET variables
Source: IDWD and IBRC, using O*NET data

Sample Occupations

- First-Line Supervisors and Managers of Construction and Extraction Workers
- Operating Engineers and Other Construction Equipment Operators
- Roustabouts, Oil and Gas
- Manufactured Building and Mobile Home Installers
- Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic
- Water and Liquid Waste Treatment Plant and System Operators

construction; and production and processing. Because these factors dominate the super cluster, they are a common thread through the sub-clusters.

Engineering and Applied Technology

This sub-cluster is marked by occupations that focus on skills in equipment monitoring and design, as well as systems and programming (see **Table 17**). Workers with knowledge in engineering and technology dominate this cluster. While this cluster includes workers needing a knowledge foundation in physics, it also includes the "-cians" such as technicians and electricians with knowledge in specialized areas. Examples of occupations in this cluster include a wide range of engineers, technicians and mechanics.

Construction and Extraction, Equipment Operation, and Repair

To build structures or extract natural resources, one needs to operate equipment, so it is not surprising that equipment operators are clustered with construction workers. Knowledge in transportation, public safety and security, and building and construction is also common to this cluster (see **Table 18**). Many types of repairers and installers are among the occupations within this cluster, in addition to production occupations.

Design and Production

The third sub-cluster is differentiated from the other two by knowledge in production and processing and design. While this cluster is similar to the first sub-cluster in the strength of engineering and technology, the artistic elements of design tend to dominate this cluster (see **Table 19**). Occupations range from artisans such as jewelers and tailors to design-oriented production jobs such as industrial engineering technicians and photographic process workers. Like the other sub-clusters, the major occupation groups are diverse: arts and design; production; and transportation and material moving.

Table 19: Design and Production Sub-Cluster: Key Occupation Factors

Category	Variable Type	Detailed Variable
R	Knowledge	Engineering and Technology
R	Knowledge	Mechanical
R	Knowledge	Physics

Source: IDWD and IBRC, using O*NET data

Sample Occupations

- Commercial and Industrial Designers
- Construction Carpenters
- Stone Cutters and Carvers, Manufacturing
- Machine Feeders and Offbearers

6.2.4 Liberal Arts, Education and Human Relations

Worker knowledge requirements dominate the most important factors for this cluster—particularly knowledge of fine arts, history and archeology, philosophy and theology, sociology and anthropology, and communications and media. Workers in this cluster also tend to have personal artistic interests. The cluster is dominated by education occupations such as postsecondary art and music teachers, music directors and some social science occupations.

> *"The occupations within a pathway cluster provide a set—albeit a large set—of potential target occupations for a displaced worker."*

6.2.5 Business, Sales and Administration

Like many of the clusters, knowledge requirements also dominate the business, sales and administration cluster. Workers require knowledge in one of the following areas: sales and marketing, economics and accounting, administration and management, personnel and human resources, and customer and personal service. Those attracted to occupations in this cluster have personal interests in starting up and carrying out projects, leading people and making decisions, and often have an appetite for taking risks. Sample occupations in this cluster span management, business and financial operations, and sales and related occupations.

6.2.6 Transportation and Public Services

Knowledge areas of public safety, transportation, law and travel services were the primary drivers that formed this cluster. Key occupations within this cluster range from aviation inspectors to police detectives and urban and regional planners. The major occupational category of transportation and material moving dominated the cluster, followed closely by the two major categories of law, public safety and security, and life, physical and social science.

6.2.7 Environmental Sciences and Food Service

This cluster, with the lowest level of similarities among the occupations, is largely defined by high scores in the worker requirements of knowledge in food production, biology and chemistry. This pathway cluster is composed of an extensive array of occupations including scientists in the natural science and environmental disciplines as well as agriculture. This is also the "food cluster" that includes dietitians and food service workers. It may not be intuitively obvious how the occupations in this cluster are comparable, but based on O*NET surveys, incumbent workers in these occupations share relatively high scores in biology and chemistry, as well as food production.

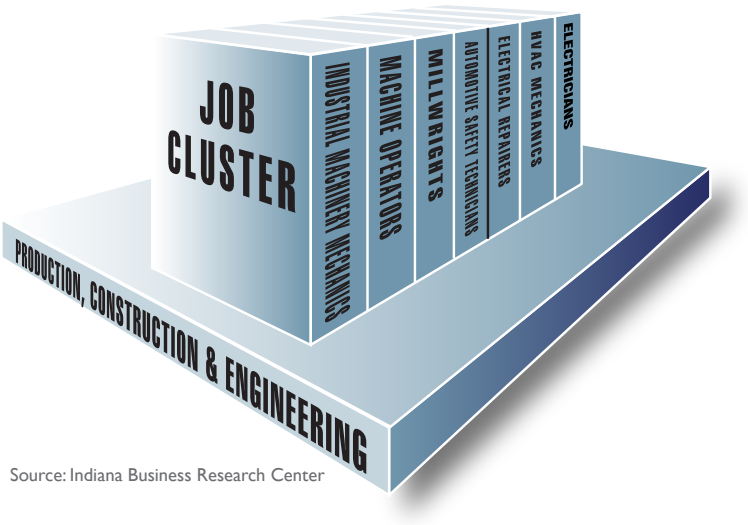
6.3 Finding and Closing the Skills Gap[32]

The pathway cluster analysis groups occupations based on the similarities and differences of over 500 job and worker characteristics. The occupations

[32] The gap, or difficulty to make a transition, between any two occupations involves more than O*NET-type skills; it may reflect differences in knowledge, abilities, physical strength and educational attainment, as well as skills. However, to be consistent with common usage, this report uses the term "skills gap" to refer to gaps between occupations in any of the relevant O*NET occupation description characteristics.

within a pathway cluster provide a set—albeit a large set—of potential target occupations for a displaced worker. **Figure 6** is a picture of this first step, namely, organizing occupations into groups based on their similarities across a wide range of job and worker requirements. Thus, the Driving Change project has not only identified the displaced workers and the green and growing occupations of promise, but the research team has developed a resource that can identify occupations that are relatively similar to the original occupation of the displaced worker. The next step for the pathway cluster work then, is to provide meaningful, user-friendly instruments to measure the skills gap between occupations and to assess the relative ease or difficulty of moving from one occupation to another.

Figure 6: Selected Occupations in the Production, Construction and Engineering Cluster



Source: Indiana Business Research Center