

# Machinery Manufacturing

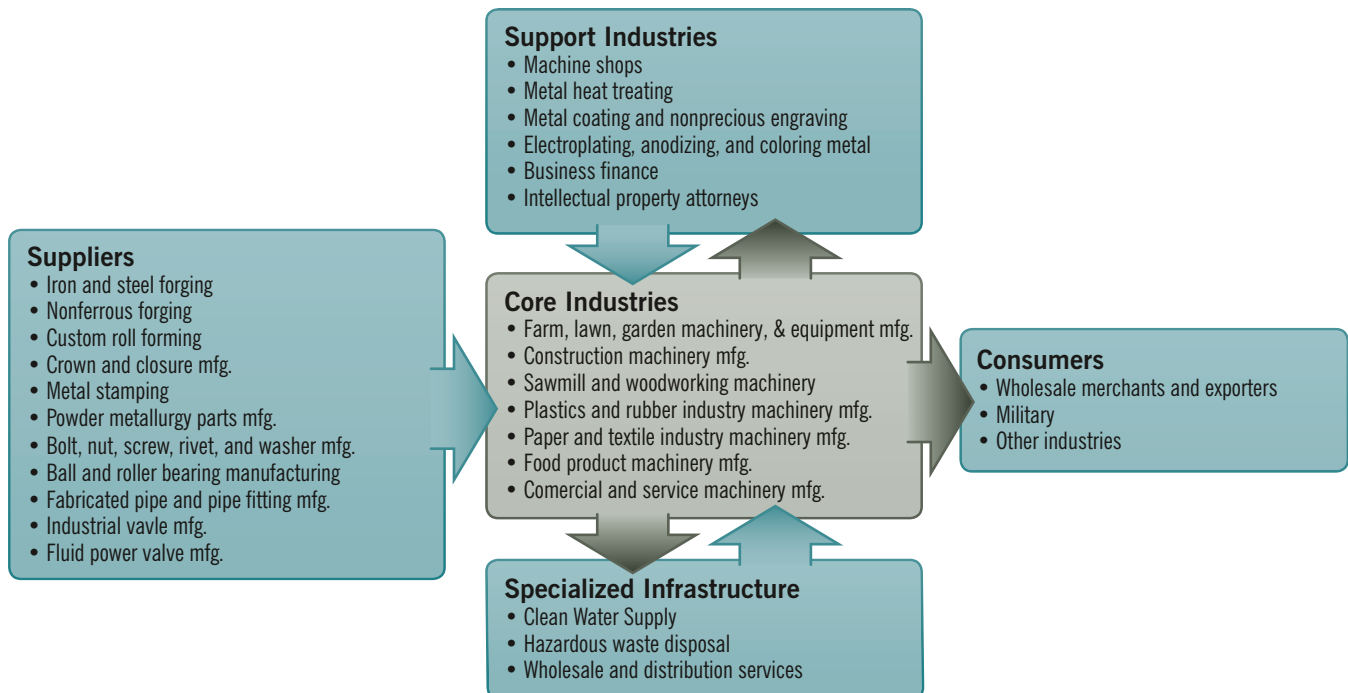
## CLUSTER SUMMARY

The *Machinery Manufacturing* industry cluster is comprised of a broad and diverse range of machinery or components used in agriculture, mining, construction, or manufacturing. Major products of companies in the five-county region include farm and construction machinery, metalworking and other manufacturing machinery, HVAC and commercial refrigeration equipment, and general-use machinery such as engines and pumps. While some products, such as tractors or heaters, are finished products, others like motors are components used in further production, and some are custom-designed for a specific manufacturing process. Machinery Manufacturing involves producing and assembling components including forging, machining, and welding activities which require skilled labor. Products have a high engineering content, and product design usually involves computer-aided design (CAD) systems, which are integrated directly into a computer-aided manufacturing (CAM) process.

## CLUSTER DEFINITION

An industry cluster is a group of similar industries which are closely connected by supply chains and/or similar labor pools located within the same region. The core strength of the Machinery Manufacturing industry cluster comes from the production of tools, structural components, and parts which are either sold as finished products or are incorporated into other manufactured goods. These core industries drive employment and inputs in other industries which supply them (e.g., agricultural, construction, and food processing machinery), as well as those which support the core industries by providing business finance and various industrial services and component manufacturers (Figure 1).

Figure 1. Machinery Manufacturing, Cluster Components



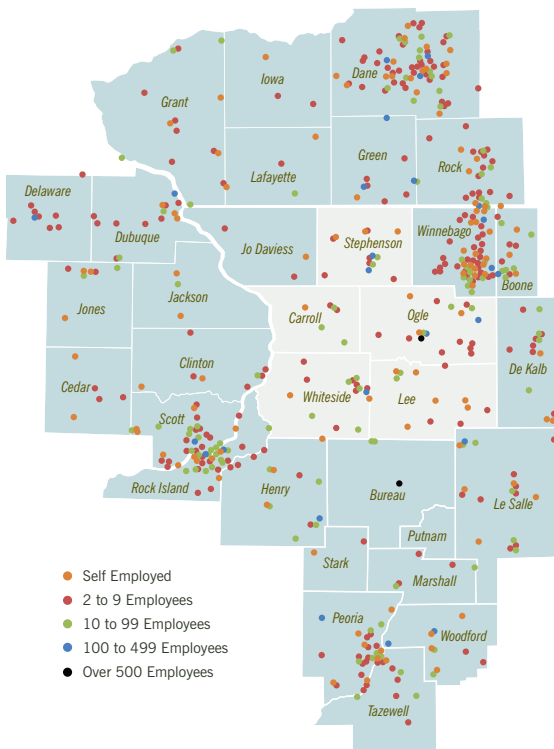
Source: The Purdue Center for Regional Development (cluster definitions), 2012.

## REGIONAL OVERVIEW

A larger 32-county region (hereafter referred to as the Reference Region) in northwest Illinois, northeast Iowa, and southwest Wisconsin including the five-county region was used to identify clusters for this project. This Reference Region had 757 establishments in 2010 and employed 26,182 people. The majority of businesses in this cluster are small in terms of employment (67.0% of firms have fewer than 10 employees) with the few large employers concentrated in the metropolitan areas (Figure 2).

The cluster also has had a consistently high concentration of employment in the five-county region with location quotients (LQ) of 2.9 in 2001, 3.9 in 2007, and 3.6 in 2010. Most industry subsectors are represented in the five-county region, with five subsectors having a strong presence in the Region based on the concentration of employment. The top five are listed in Figure 3.

**Figure 2.** Machinery Manufacturing: Firms by Employment Size Class



Source: DecisionData.net, 2011.

In 2010, the five-county region had 60 establishments and employed 2,145 people in direct cluster jobs. This cluster has a higher than average concentration of economic activity, as defined by firm and employment LQ, in both the Reference Region and the five-county region, when compared to the nation's economic activity in this cluster overall (Figure 4).

**Figure 3:** Machinery Manufacturing: Subsectors Based on Employment Concentration

Indicator	Location Quotient (2010)
Mechanical power transmission equipment manufacturing	21.0
Construction machinery manufacturing	18.9
Speed changer, industrial high-speed drive, and gear manufacturing	11.0
Fluid power process machinery manufacturing	8.5
Farm machinery and equipment manufacturing	7.7

Source: IMPLAN, 2010.

**Location Quotients (LQ)** are used to evaluate local development opportunities and find businesses which are especially suited for the Region. A LQ is the ratio of the employment percentage represented by a given industry in the county to the percentage which the industry represents in the state or a representative area of interest. A ratio greater than one indicates a higher local concentration and a likelihood of exports from the county; a ratio less than one may suggest that goods or services are being imported into the Region.

**Figure 4:** Machinery Manufacturing: Economic Activity Summary

Indicator	Five-County Region	Reference Region (32 Counties)
Number of Firms (2010)	60	757
Percent Change in Number of Firms (2007-2010)	9.8%	-1.9%
Firm Location Quotient (LQ)	3.5	2.5
Employment (2010)	2,145	20,796
Percent Change in Employment (2007-2010)	-22.8%	-23.6%
Employment Location Quotient (LQ)	4.0	4.3

Sources: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW) and the Purdue Center for Regional Development (cluster definitions), 2012.

# INDUSTRY CLUSTER PROFILE

Although there are few large employers within the five-county region (only four firms have 100 or more employees), the surrounding metropolitan areas have major national and global companies in this industry cluster (Figure 5).

Companies in the Region manufacture parts and components for the agricultural equipment, mining, and construction industries as well as finished products.

**Figure 5:** Machinery Manufacturing: Major Employers, Five-County Region

Company Name	# of Employees	NAICS Industry Description*	City
Sauer-Danfoss Company	150	Fluid Power Pump and Motor Manufacturing	Freeport
Seaga Manufacturing, Inc.	131	Automatic Vending Machine Manufacturing	Freeport
TNT Steel Industries, Inc.	128	All Other Industrial Machinery Manufacturing	Freeport
IFH Group, Inc.	100	Fluid Power Pump and Motor Manufacturing	Rock Falls
Frantz Manufacturing Company	95	Conveyor and Conveying Equipment Manufacturing	Sterling
Star Forge, Inc.	80	Farm Machinery and Equipment Manufacturing	Freeport
Imeco, Inc.	70	Air-Conditioning and Warm Air Heating Equip. and Commercial and Industrial Refrigeration Equip. Manufacturing	Dixon
Astec Mobile Screens, Inc.	68	Conveyor and Conveying Equipment Manufacturing	Sterling
Sewer Equipment Company of America	35	Other Commercial and Service Industry Machinery Manufacturing	Chadwick
Bonnell Industries, Inc.	35	Construction Machinery Manufacturing	Dixon

\*North American Industry Classification System.  
Source: Dun & Bradstreet, Inc., 2012.

## INDUSTRY TRENDS<sup>1</sup>

### Concentration of Industry Segments:

Although the industry in general is fragmented, some segments are highly concentrated. In farm machinery production, the top four manufacturers have nearly 60.0% of the market. Other segments, such as industrial machinery and metalworking machinery, are fragmented.

### Globalization of Multiple Sectors:

U.S. machinery manufacturers face greater competition in export markets both from makers of sophisticated machinery (Japan and Germany) and from producers of low-cost, low-technology machinery (China and Mexico). The transfer of some U.S. manufacturing capacity to other countries has expanded the international trade in machinery.

### More Computer Controls:

Industrial applications are the largest consumers of computer chips. New versions of standard machinery feature advanced electronic applications. The greater use of computer components requires manufacturers to develop new engineering skills.

### New Factory Designs Require Versatile Machinery:

To respond to changing customer demand, more manufacturers prefer machinery which can easily be reconfigured in production work. With metalworking machinery, for example, manufacturers prefer machinery which can easily switch between different types of cutting heads.

<sup>1</sup> Source: Hoovers, Inc., 2013. (www.hoovers.com)

## MARKET OPPORTUNITIES<sup>2</sup>

### Renewed Emphasis on Energy Efficiency:

Unstable energy prices have created a need for more efficient industrial machinery. Deere, one of the world's largest industrial machinery manufacturers, has recently expanded its line of fuel efficient six-cylinder tractors. Caterpillar uses lightweight materials such as titanium alloys to increase fuel efficiency for many models.

### Improving Design Processes:

New machinery design and manufacturing technologies have greatly improved machinery effectiveness and lowered costs. New CAD simulation software can provide a virtual prototype of the product or machine before a physical model is built and reduce costly product design and physical testing. Rapid prototyping, a new type of manufacturing process, is used to make small machinery parts.

### Potential Growth in Selected Segments:

Some segments of the Machinery Manufacturing industry have grown more rapidly than others. Government incentives could boost HVAC equipment sales, and farm machinery exports have the potential to increase as populations in developing countries grow. Recent technological innovations have increased the demand for the machinery used in extracting oil and gas from shale formations. Manufacturers who are able to operate in multiple niches may have advantages.

<sup>2</sup> Source: Hoovers, Inc., 2013. (www.hoovers.com)

## SUPPLY CHAIN

The supply chain analysis provides insight into the value of supply chain inputs, the amount of inputs produced in a region for the industry clusters studied (represented in most cases by an absorption rate), and the stages along the supply chain which stand out as areas of competitive advantage. High absorption represents areas along the Machinery Manufacturing supply chain which allow the Region to capture the most value from a specific stage in the production or delivery of products and services within the supply chain.

Conversely, stages along the supply chain which are underperforming offer opportunities for business attraction and/or entrepreneurship. When reviewing data relating to industry inputs, comparing both the absorption rate and the total value of inputs is important since services or components which maintain a high absorption rate may be of low value to the regional economy. Similarly, certain inputs, regardless of value or absorption, may be of high strategic importance to the Region in its efforts to build a stronger industry cluster.

The supply chain information provided here indicates the flows of trade which support Machinery Manufacturing-related industries both within the five-county region and outside the Region. The key sectors which may be appropriate targets for expansion are imports (gaps) from outside the Region, but still within the industry cluster. These gaps are then analyzed in terms of regional strengths and potential areas for targeting and support and are placed into a supply chain model in order to determine the stages of the supply chain with the strongest regional presence. To fully develop a Machinery Manufacturing cluster, the Region can make the most progress by focusing on sectors which do not yet have a strong regional presence, but which have significant development potential (Figure 6).

### Supply Chain

An essential component for an industry cluster is the local supply chain. While not all inputs (goods or services) which an industry cluster needs can be produced in the local economy, it is desirable to meet as many of the cluster's needs locally as possible. This analysis reveals the source and amount of purchases among the unique niches within an industry. By identifying the total industry economic outputs and areas where goods and services are purchased from outside the regional economy, one can better determine which areas of the industry supply chains are strongest, as well as those which present the best opportunities for growth within the five-county region.

### Regional Supply Gap

Difference between Gross and Regional Inputs: a large gap value indicates that a large amount of inputs are imported into the region, rather than produced within the five-county region.

### Regional Inputs

The dollar value of gross inputs which are produced within the Region.

### Gross Inputs

Total dollar amount of inputs used by the industry within each sector.

For example, the regional Machinery Manufacturing cluster requires \$54.9 million in inputs (i.e., the products or services which are required to create a finished product) from the "other engine equipment" industry. However, only \$319,000 of the required inputs from this industry are produced within the Region with the balance being purchased from outside the five-county region. This indicates an opportunity for an existing firm or new business to satisfy the regional demand for these products.

The supply chain gap for "machine shops" also presents a unique opportunity for existing business development. In general, machine shops produce a wide variety of parts or components based on customer requirements. Since most machine shops specialize in low-volume, fast-turnaround orders, they are quite versatile and are limited only by their production equipment and the skills and capabilities of their workers. Therefore, a regional initiative aimed at expanding the capabilities of machine shops could help meet the supply chain needs of several key manufacturing sectors.

# INDUSTRY CLUSTER PROFILE

**Figure 6:** Machinery Manufacturing: Largest Supply Chain Gaps

Industry	Regional Supply Gap	Regional Inputs	Gross Inputs	% Purchased Outside Region
Other engine equipment	-\$54,614,232	\$319,343	\$54,933,575	99.4%
Motor vehicle parts	-\$38,664,092	364,104	39,028,196	99.1
Valves and fittings other than plumbing	-\$19,486,760	202,006	19,688,766	99.0
Fluid power process machinery	-\$16,939,335	265,524	17,204,859	98.5
Motor and generators	-\$16,230,766	11,850	16,242,616	99.9
Machine shops	-\$8,341,666	17,745	8,359,411	99.8
Speed changers, industrial high-speed drives, and gears	-\$8,265,635	111,003	8,376,638	99.0
Relay and industrial controls	-\$8,014,944	12,326	8,027,271	99.9

*Source: IMPLAN, 2010.*

## WORKFORCE REQUIREMENTS, SUPPLY AND DEMAND

Even as employment in Machinery Manufacturing has declined during the past decades (a trend that is projected to continue) the supply of potential new workers is comparatively low because of demographic trends and the propensity of younger workers to pursue careers outside of manufacturing. More than half of the workers employed in the industry in 2010 were 45 years of age or older, with only 6.6% under the age of 25 (Figure 7).

**Figure 7:** Machinery Manufacturing: Employment and Wages by Age Group, Five-County Region, 2010

Age Group	Employment (% of Total)	Average Annual Wage
Under 25 Years	6.6%	\$23,816
25-44 Years	39.6	42,032
45-64 Years	51.2	51,818
65 Years & Older	2.7	55,826
<b>Total/Average</b>	<b>100.0%</b>	<b>\$39,372</b>

*Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2011.*

Over 60.0% of the employment, as well as over 50.0% of the wages, in the Machinery Manufacturing cluster are concentrated in Production; Installation, Maintenance, and Repair; or Transportation and Material Moving occupations (Figure 8). Production and the related employment classifications account for the largest single share of the jobs in the five-county region. Ensuring that appropriately skilled production workers are available at competitive rates of compensation will be critical to maintaining the Region's Manufacturing sector.

### Other Engine Equipment (NAICS Sector 33631)

Firms in this industry manufacture internal combustion engines (except automotive gasoline and aircraft). Subsectors include the following:

- » Diesel and semi-diesel engines
- » Gasoline engines (except aircraft, automotive, truck)
- » Natural gas engines
- » Governors



# INDUSTRY CLUSTER PROFILE

**Figure 8:** Machinery Manufacturing: Staffing Patterns, Five-County Region

Occupational Classification	Share of Employment	Share of Wages	Average Annual Wage
Production	55.7%	44.0%	\$36,253
Office and Administrative Support	10.5	8.3	36,227
Architecture and Engineering	8.5	12.1	65,117
Management	5.7	13.9	111,236
Installation, Maintenance, and Repair	4.2	4.0	44,311
Transportation and Material Moving	4.2	2.7	30,352
Business and Financial Operations	3.7	5.0	62,106
Sales and Related Occupations	3.4	5.1	69,258
Computer and Mathematical	1.5	2.3	68,343
Construction and Extraction	1.1	1.1	44,096

Sources: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW) and the Purdue Center for Regional Development (cluster definitions), 2012.

The challenge for employers is the looming demand for replacement workers as older workers retire. According to the Illinois Department of Employment Security, 196 openings for

production workers will become available annually between 2008 and 2018, mainly from the demand for replacement workers (Figure 9).

**Figure 9:** Occupational Employment, Projected Demand by Worker Classification, Workforce Investment Board Region #4, 2008-2018\*

Occupational Classification	Employment		Employment Change 2008-2018		Average Annual Job Openings		
	2008	2018	Number	%	Growth	Replacement	Total
Production	9,653	8,806	-847	-8.8	5	191	196
Transportation and Material Moving	6,297	6,479	182	2.9	25	153	178
Management	7,959	7,693	-266	-3.3	13	123	136
Architecture and Engineering	1,116	1,073	-43	-3.9	3	25	28
Installation, Maintenance, and Repair	2,798	2,930	132	4.7	15	55	70

\*Workforce Investment Board (WIB) Region #4 consists of Carroll, JoDaviess, Ogle, Stephenson, and Whiteside counties.

Source: Illinois Department of Employment Security, 2012.

Compensation levels are a concern for local businesses because the surrounding metro areas compete for workers with specific skills or experience<sup>3</sup>. For example, the projected demand for production workers in the metro areas around the five-county region is estimated to be 2,398 openings per year between 2008 and 2018<sup>4</sup>. The estimated average annual wage for production workers is \$36,200<sup>5</sup>. While this matches the wages for the

five-county region, the surrounding metro areas have the added advantage of a greater number of employers and more job opportunities from which to choose within a reasonable commuting distance. Given the expected intense competition for skilled workers, companies will have to monitor compensation trends in order to recruit and to retain qualified employees.

<sup>3</sup> Northern Illinois University, Center for Governmental Studies, "Promoting Regional Prosperity in Northwest Illinois: Wage and Benefit Report", August, 2012, p.23.

<sup>4</sup> Source: Illinois Department of Employment Security, 2012.

<sup>5</sup> Sources: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW) and the Purdue Center for Regional Development (cluster definitions), 2012.

## BUSINESS OPERATING COSTS

Annual operating costs are provided solely for comparisons. Only major geographically variable operating costs are included for a series of seven county sites in the U.S. These consist of the five counties in the Region along with two additional counties which have significant concentrations of businesses in the Machinery Manufacturing cluster. One of the two out-of-state counties is located in the Midwest region, and the second is located in an alternative U.S. region. Costs which did not vary significantly with geography, including relocation and start-up expenses, were not considered (Figure 10).

**Figure 10:** Machine Manufacturing: Total Geographically Variable Operating Cost Comparison

County Name	Total Annual Operating Costs
Snohomish County, WA	\$18,965,960
Racine County, WI	15,678,227
<b>Stephenson County, IL</b>	15,436,093
<b>Ogle County, IL</b>	15,386,337
<b>Whiteside County, IL</b>	15,317,486
<b>Lee County, IL</b>	15,125,935
<b>Carroll County, IL</b>	15,053,989

*Source: The Boyd Company, Inc., 2012.*

The five-county region was the most competitive with its peers in terms of labor costs and site acquisition and property tax costs. The Region was also more cost-effective in terms of shipping costs versus the comparative counties, highlighting the importance of northwest Illinois' transportation assets and its access to national and global markets.

### Costs of Doing Business

Since most businesses operate in a real-time global marketplace, their focus is on maintaining a comparative advantage through sourcing and supplying products profitably. Cost components such as labor, taxes, real estate, and utilities are the key measures which most companies use to decide where to locate or expand their operations.

**Operating cost analysis** focuses on those key geographically variable cost elements which are considered to be the most pivotal within the corporate site selection process and overall target industry competitiveness.

## KEY TAKEAWAYS

- » The Machinery Manufacturing cluster in the Region has a concentration of firms which is 3.5 times the national average, and an employment concentration that is 4.0 times the national average. The Region has maintained these advantages despite the impact of the recent recession and the long-term decline in the number of manufacturing businesses and employment.
- » The Machinery Manufacturing cluster is diverse and several subsectors are represented in the five-county region. Some have the potential for further development based on supply chain relationships with other industries in the Region and the surrounding metro areas.
- » Opportunities likely exist for companies to develop new supply chain relationships with companies in the nearby metro areas or outside the industries that they already serve, but more research is needed to identify and develop those opportunities.
- » The supply chain gap for machine shops presents a unique opportunity for the expansion of existing businesses. A regional initiative aimed at expanding the capabilities of machine shops could benefit the supply chain needs of several key Machinery Manufacturing sectors.
- » Small niche manufacturers (such as machine shops) can be supported as part of a strategy to support small businesses and entrepreneurship in the Region.
- » Production and related employment accounts for 23.0% of the jobs in the Region. Ensuring that appropriately skilled production workers are available at competitive compensation rates will be critical to maintaining the Region's Machinery Manufacturing cluster.
- » The expected wave of retiring Baby Boomers will create most of the demand for new workers, despite static, or even declining, overall employment in the industry. Other manufacturing sectors will experience the same challenges making the competition for workers even more intense.

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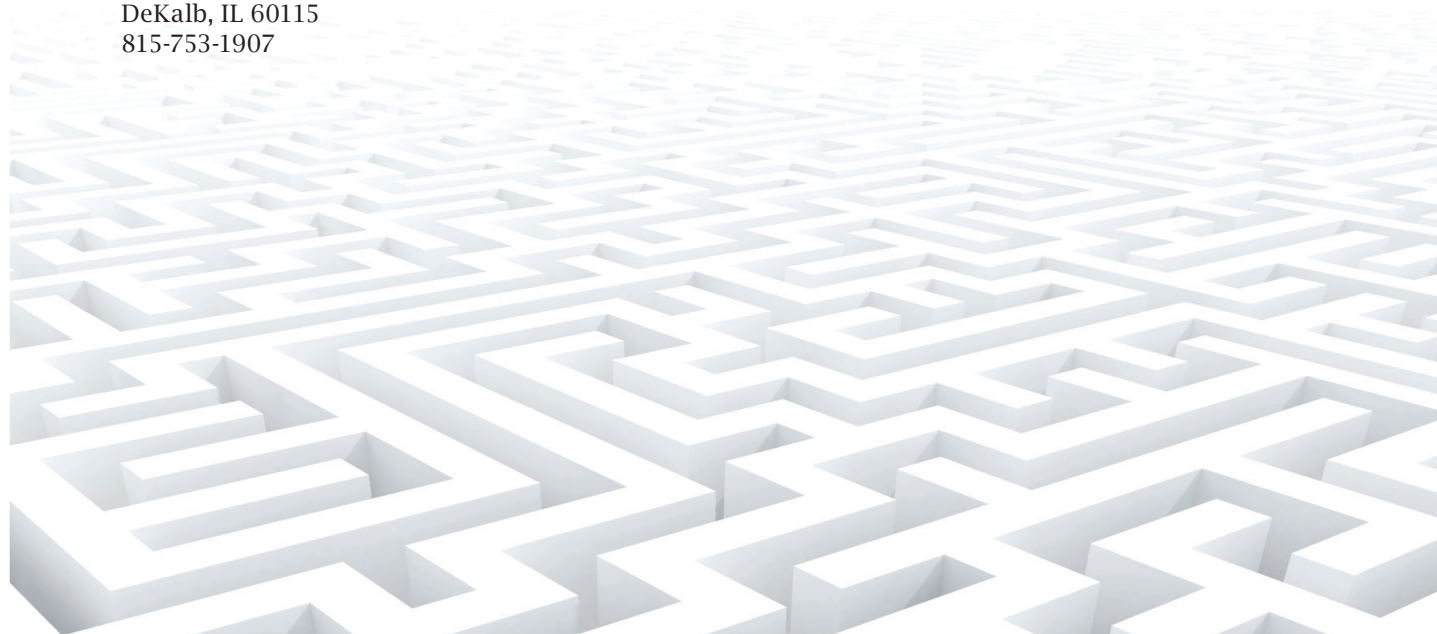


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