



C-Stone Technologies Research Report

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December 5, 2016

PREFACE

C-Stone Technologies is a Korean company focused on innovations in power transmission systems. They are currently seeking business opportunities in North America for commercializing their Advanced Power Shift Clutch (APSC) with Power Piston Module (PPM) technology in the tractor, forklift and commercial vehicle transmission fields.

The IC² Institute's Global Commercialization Group (GCG) at UT Austin "facilitates the growth and development of innovative technology-based businesses in a variety of regions worldwide". This research was undertaken in partnership with the GCG in order to explore market possibilities for C-Stone Technologies.

Executive Summary

Our group conducted research on the following areas:

- Markets for components for consumer vehicles, commercial vehicles, agricultural vehicles, and forklifts.
- The component supply chain for consumer and commercial vehicles.
- Drivers for innovation in the markets listed above.

Significant qualitative findings:

- A new transmission technology could be attractive in **consumer vehicle, commercial vehicle**, and **agricultural vehicle** markets.
- These are all mature, global markets with steady growth rates.
- These markets have supply chains that are built on stable relationships.
- There is an appetite in these markets for innovation that results in efficiency.

Information Problem and Research Process

After consulting with our client at the IC² Institute's GCG, we determined that we would focus our secondary market research on these questions:

- What is the go-to-market strategy for a new transmission product?
- How big are the tractor, forklift, and car markets in general?
- Where does drive for innovation in these markets come from?
- What is the component supply chain like in these markets?

We conducted secondary research using investment bank reports from the Thomson One database, market reports from the IBISWorld database, company lists generated using the Capital IQ database, publicly accessible business school course materials, automotive industry trade literature, and corporate websites and financial disclosure documents.

We were not able to answer the first question, “What is the go-to-market strategy for a new transmission product?” Our secondary research attempted to answer it, but we believe that this question would be better answered through primary research.

Results

Detailed results of our research are discussed in “Part 1” of this document. Part 1, “Market Overview”, provides perspective on possible markets for C-Stone Technologies’ transmission product, including market sizes and an extensive list of transmission component suppliers analyzed using a magic quadrant methodology. Part 2, “Insights”, includes analysis and predictions of the transmission components market’s dynamics, based on our analysis in Part 1 and our analysis of automotive industry supply chains.

PART I: MARKET OVERVIEW

Market Size & Forecasts

We took a two-pronged approach to researching market size. First, we looked at the overall market size for clutches and transmissions in the US, since C-Stone has expressed interest in entering that market. Second, we examined the global dual clutch transmission (DCT) market, since we identified DCTs as an indirect competitor for C-Stone's product.

Different sources provide different definitions of the market and different estimates of market size. HSBC Global Research's October 2016 initiating coverage report on Eaton Corp. [7] states that Eaton's management estimates the clutch and transmission market is at \$4B in 2016 and growing at 2% CAGR. However, IBISWorld's "Automobile Transmission Manufacturing in the US" [3] report states that total US automobile transmission revenue in 2016 is about \$41.3 B, with the "torque converters, clutches, and transmission gears" segment constituting 10.1% of the market, or \$4.17B. Our conclusion is that the US clutch and transmission market is about \$4B in 2016.

Dual clutch transmissions are an indirect competitor to C-Stone's product, as they offer some of the same performance and efficiency benefits.

- The global DCT market is expected to reach \$15,356M by 2020 at an estimated CAGR of 11.2%, per a LexisNexis report [1] [2].
- Asia Pacific & North America together contributed around 48% to the global DCT market revenue in 2014 [2] [3].

- According to an IBISWorld report ("Automobile Transmission Manufacturing in the US") [3], the total US automobile transmission market is \$41.3B in 2016.
- Automatic transmissions account for 33.9% of this market (\$14B) [3]. This category includes dual clutch transmissions.

For larger versions of these charts, please see **Appendix A**.

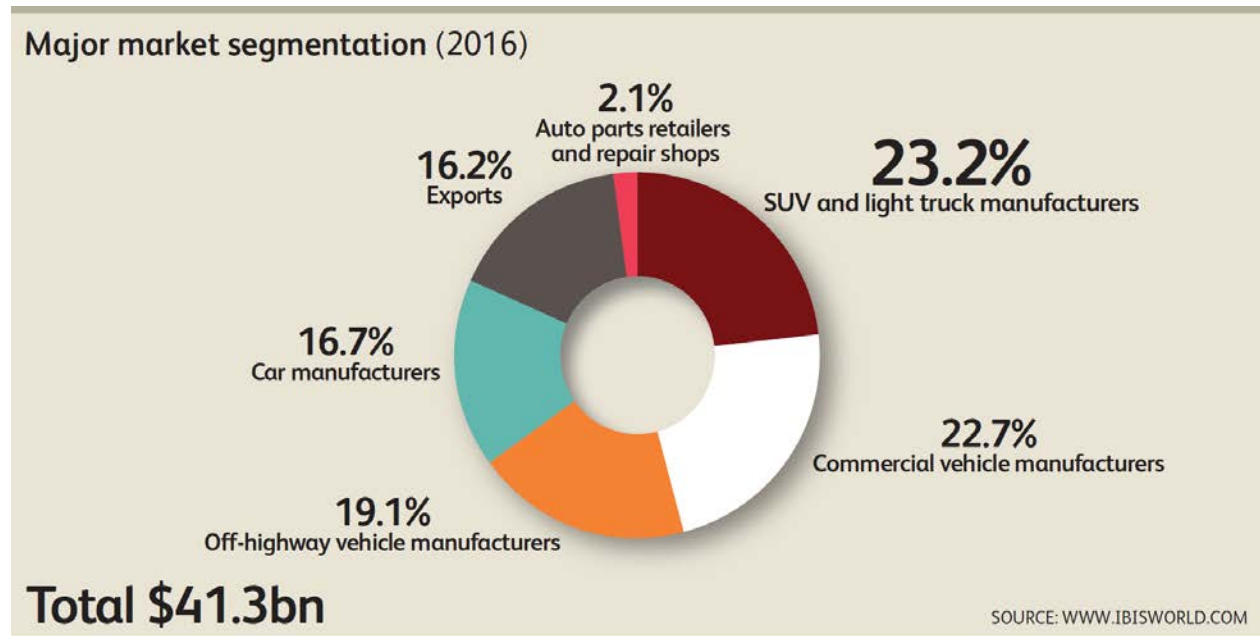


Figure 1. Major Market Segmentation [3]

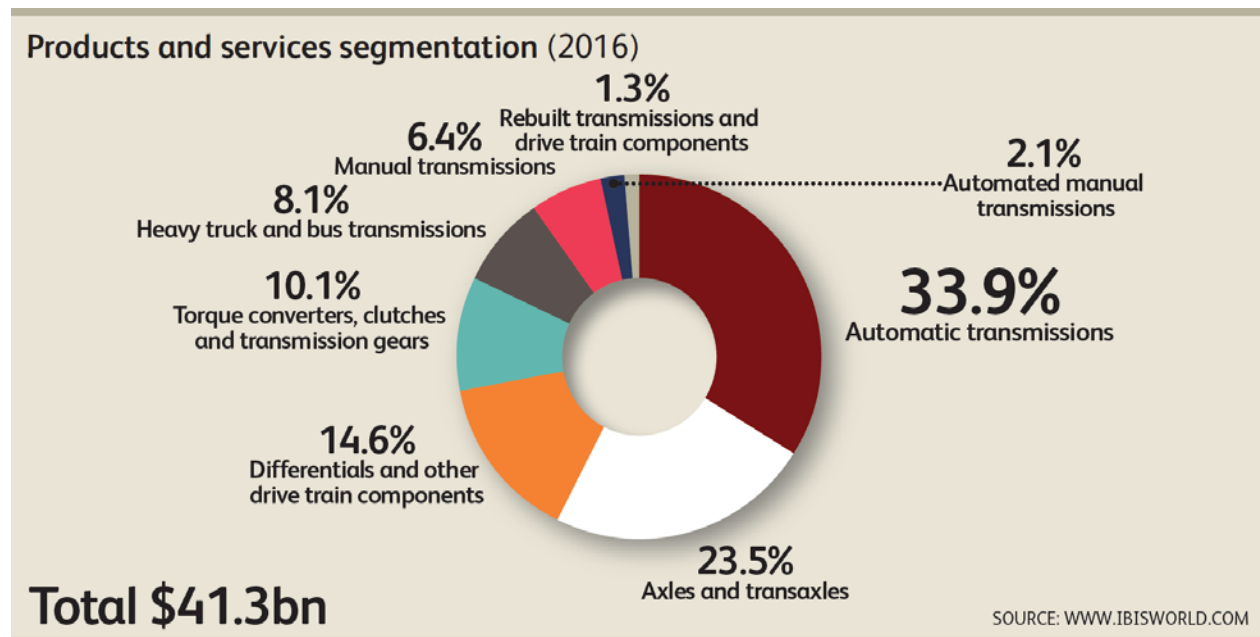


Figure 2. Products and Services Segmentation [3]

Top Suppliers

1. Eaton Corporation
2. Magna International
3. BorgWarner
4. Linamar
5. Dana Holding Corp.
6. ZF Friedrichshafen AG
7. Exco Technologies Limited
8. Martinrea International Inc.
9. American Axle & Manufacturing Inc.
10. Allison Transmission Inc.
11. Schaeffler Technologies
12. Twin Disc, Inc.

Market Opportunities

We analyzed three separate market segments that are potential buyers of C-Stone's product: forklift transmissions, commercial vehicle transmissions, and off-highway motor vehicle transmissions.

Segment Trend & Opportunities Analysis

Forklift Automobile Transmission: Growing

As per our research, the forklift automobile transmission segment is experiencing growth thanks to the growth of forklift industry. Per IBISWorld [4], the US forklift industry has \$9.8B of market size, at a growth rate of 3%. (This is the entire industry, not just the transmission segment.) The rising demand for forklifts results in rising demand for clutches and transmission components. In addition, the increasing trend of import forklifts and intense competition regarding fuel efficiency and product quality offer C-Stone an opportunity to enter this segment.

Commercial Vehicles Automobile Transmission: Growing

In 2016, the commercial vehicle transmission segment has a market size of \$9.4B (IBISWorld 2016) [3]. Like the forklift automobile transmission segment, the commercial vehicles automobile transmission segment is expected to grow and expand. The growth of commercial business contributes to a rising demand for transportation and logistics services, which stimulates the commercial industry at a growth rate of 5.9% (Global Industry Analyst, Inc.) [5]. This further stimulates the demand for commercial vehicle transmissions. Rising eco-awareness and demand for low carbon emission products make fuel efficiency more attractive.

Off-highway Motor Vehicles (Tractors) Automobile Transmission: Growing

In 2016, the off-highway motor vehicles automobile transmission segment represents a \$7.9B market (IBISWorld 2016) [3]. Per IBISWorld [3], sales of off-highway motor vehicles are anticipated

to grow at a stronger rate. Stricter EPA emissions standards lead to greater demand for fuel-efficient products. These factors could lead to a competitive advantage for C-Stone if and only if its product offers greater fuel efficiency than its competitors.

Threats & Tips

Segment Concentration Rate: Medium to High

Even though the concentration rate of the whole automobile transmission industry is low (IBISWorld 2016) [3], the concentration in these three segments is medium to high. The leading suppliers account for over 50% of market share. This leads to relatively high barriers of entry, since leading suppliers typically have stable relationships with downstream vendors.

Cost Structure: High COG (66%)

Per IBISWorld [3], the cost of goods sold in the automobile transmission industry accounts for 66% of sales, which is extremely high compared to other industries. The high COG tightens the profit margin of the players in this industry, making suppliers more price sensitive.

Trade Associations

We suggest these trade associations as targets for future primary research.

- Alliance of Automobile Manufacturers, autoalliance.org
- Association of International Automobile Manufacturers, globalautomakers.org
- Heavy Duty Distribution Association, autocare.org
- Motor & Equipment Manufacturers Association, mema.org
- Original Equipment Suppliers Association, oesa.org
- United States Council for Automotive Research, uscar.org

Magic Quadrant



Figure 3. Magic Quadrant (CapIQ & IBISWorld)

For a larger version of this Magic Quadrant, please see **Appendix B**.

This Magic Quadrant diagram includes 22 transmission and transmission component suppliers. Many of these companies are based in North America, with some European and Asian companies included. Garner [6] defines the four Magic Quadrant sectors as follows:

Leaders execute well against their current vision and are well positioned for tomorrow.

Visionaries understand where the market is going or have a vision for changing market rules, but do not yet execute well.

Niche Players focus successfully on a small segment, or are unfocused and do not out-innovate or outperform others.

Challengers execute well today or may dominate a large segment, but do not demonstrate an understanding of market direction.

Leaders

ZF Friedrichshafen AG

- Primarily in the industry for powertrain technology and automatic transmissions and manual/dual clutch transmissions
- Established in 1915
- 135,969 employees
- German company

JATCO

- Focuses on transmissions for small, medium, and large vehicles and hybrid front wheel drive and rear wheel drive vehicles
- Established in 1999
- 6,564 employees
- Japanese company

Twin Disc Inc.

- Specializes in heavy duty off-highway power transmission equipment worldwide. Does manufacturing and distribution in transmissions and clutch. Has large distributor network.
- Established in 1918
- 742 employees
- US company

Allison Transmission

- Although Allison Transmission has small number of employees, it is a very old and experienced company that focuses specifically on designing, manufacturing and selling transmission products in the automotive industry.
- Established in 1915
- 2,700 employees
- US company

Schaeffler AG

- They create and supply a range of products such as belts and chain drive systems and components. They also have a subsidiary that supplies and manufactures transmission and clutch products.
- Established in 1883
- 86,029 employees
- US company

BorgWarner Inc.

- Deals primarily with transmissions and clutches
- Established in 1880
- 30,000 employees
- US company

Challengers

Magna International

- Huge international company that does work on transmissions and clutches, but also a ton of other automotive manufacturing
- Established in 1957
- 155,000 employees
- Canadian company

Dana Holding Corp.

- Does transmissions manufacturing, but also ton of auto manufacturing
- Established in 1904
- 23,800 employees
- US company

Valeo SA

- Does transmission manufacturing, but also a lot of other auto manufacturing
- Established in 1923
- 88,000 employees
- French company

Mahle GmbH

- Mainly does work in regards to pistons
- Established in 1920
- 75,635 employees
- German company

GKN

- They have division that makes engines and transmissions along with various other automotive parts
- Established in 1902
- 56,000 employees
- U.K. company

Linamar Corp.

- Larger older company with work in transmissions and has a large distribution network (America, Canada, and North and South America).
- Established in 1966
- 24,500 employees
- Canadian company

Visionaries

Clutchco International

- Manufactures mechanical power transmission equipment, specializing in clutches. They have recently been trying to grow, considering different products and services.
- Established in 1998
- 40 employees
- US company

Boston Gear LLC

- Manufactures and markets specifically transmission products
- Established in 1877
- 270 employees
- US company

Weasler Engineering

- Distributes mechanical power transmission products for original equipment manufacturers in agricultural, lawn and turf, construction, industrial, and marine markets. They have a few different products and are trying to innovate their products
- Established in 1951
- 300 employees
- US company

G&G Manufacturing Company, Inc.

- Mainly does transmission/clutches to OEMs and distributors, but it's a tiny company
- Established in 1943
- 120 employees
- US company

Hyundai Dymos Inc.

- Focuses on just transmission products for various types of vehicles like sedans, SUVs, buses, trucks, etc.
- Established in 1994
- 1,116 employees
- South Korean company

KSPG AG

- Large product line and engages in development, manufacture, and aftermarket supply of pistons and other parts
- Established in 1998

- 11,700 employees
- German company

Metaldyne Performance Group Inc.

- Manufactures and sells various products including transmission components to OEMs. They have a good supply network, but are a very young company.
- Established in 2010
- 12,000 employees

Niche

Nexen Group, Inc.

- Manufactures transmissions and controls for industrial applications and machines.
- Established in 1999
- 150 employees
- US company

Butler Gear Company

- Manufactures and sells special gears and transmission products and has repair services for their products. However, it's mainly for new machines and equipment and not as much the automotive industry.
- Established in 1960
- 30 employees
- US company

Metaris Corp.

- Focuses on one market and their specific product line to that market – hydraulic.
- Established in 1999
- 45 employees
- US company

PART II: INSIGHTS

Innovation Drivers

Consumer demand

OEMs find demands from consumers and thus facilitate the demands and innovation of products based on their needs and their consumer's needs.

Electrification of vehicle drivelines

As electric and hybrid cars are becoming more prevalent on the market, we are seeing more electronic technologies for different types of vehicle transmissions on the market. This deviates from the traditional transmission model.

Fuel-efficiency standards

The automotive industry has undergone a shift toward fuel efficiency and emissions reduction standards, which have resulted in new engines and transmissions. This suggests that this C-Stone innovation might be attractive.

Cost efficiency & “light-weight” design principles

Anything that can be used to make the production cost of the vehicle cheaper, while still being just as effective, is always going to be a major driver. Another focus recently has been in attempts to make vehicles lighter as it helps with fuel efficiency.

Push for “eco-friendly” and recyclable materials

As we see more “eco-friendly” hybrid and electric cars this has become to be something users and customers really care about and take into consideration. Vehicles and parts that can be advertised as such are being considered much more and are beginning to drive the market.

Supply Chain Analysis

The drive for innovation in the auto industry comes from auto manufacturers and Tier 1 (\$10b+) suppliers. We believe this is due to the complexity of the automotive industry supply chain: to make a change, an innovator must have a certain amount of clout.

The supply chain for transmissions and transmission components is global. While some manufacturers do nurture closer relationships with suppliers who are geographically closer, it is the norm for American manufacturers to use parts produced in Europe or Asia. In our magic quadrant, 61% of transmission suppliers were based in North America, 30% in Europe, and 9% in Asia.

Powertrain components, including clutches, are “less commoditized” than other parts. This is due to the complexity of these parts (as compared to, say, car doors, which can be manufactured with

more flexibility). This gives suppliers of transmissions and transmission components more power when it comes to contract negotiation and part specifications, which means that the powertrain could be a promising area for innovation by a newcomer with a product that improves performance.

CONCLUSION

In conclusion, we believe IC² Global Commercialization Group & C-Stone should keep in mind these points:

- Fuel efficiency is the most attractive thing a product can offer.
- New products often enter the auto industry at a global scale.
- The transmission market is composed largely of many small players, but barriers to entry are still high.

A full list of the research reports used in this document can be seen in **Appendix C**.

Directions for Future Research

We identified the following questions for future primary and secondary research:

- How does C-Stone’s product compare to dual-clutch transmissions? Does it compete, directly or indirectly?
- Are the performance metrics for C-Stone’s product attractive to Tier 1 suppliers?
- What is the go-to-market strategy for a new transmission product?

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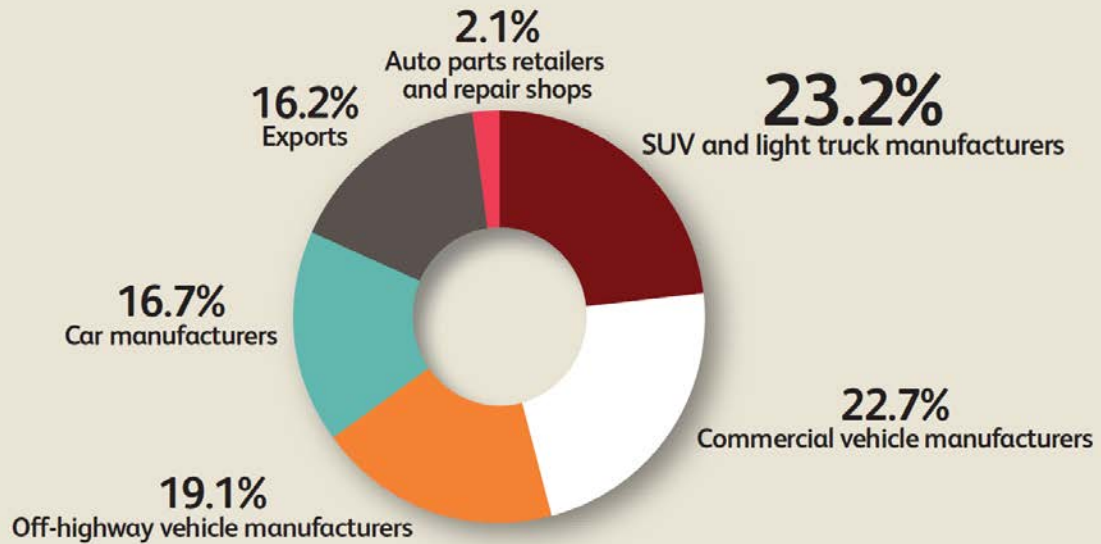
Loretta Wallace, MLS, UT Austin Business Librarian: UTBusinessLibrarian@lib.utexas.edu

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- [2] "Clutch Market for Automotive worth \$10,676 Million by 2019", Markets and Markets, LexisNexis, 2016.
- [3] "Industry Report 33635: Automobile Transmission Manufacturing in the US", IBISWorld, 2016.
- [4] "Industry Report OD4919: Forklift Manufacturing in the US", IBISWorld, 2016.
- [5] "The global commercial vehicle market", Global Industry Analyst, Inc, 2015. Retrieved from http://www.strategyr.com/MarketResearch/Commercial_Vehicles_Market_Trends.asp.
- [6] "Gartner Magic Quadrant", Gartner, 2016. Retrieved from http://www.gartner.com/technology/research/methodologies/research_mq.jsp.
- [7] "HSBC Global Research Initiating Coverage Report on Eaton Corp.", HSBC Global Research, October 2016.

APPENDIX A - Market & Product Segmentation

Major market segmentation (2016)

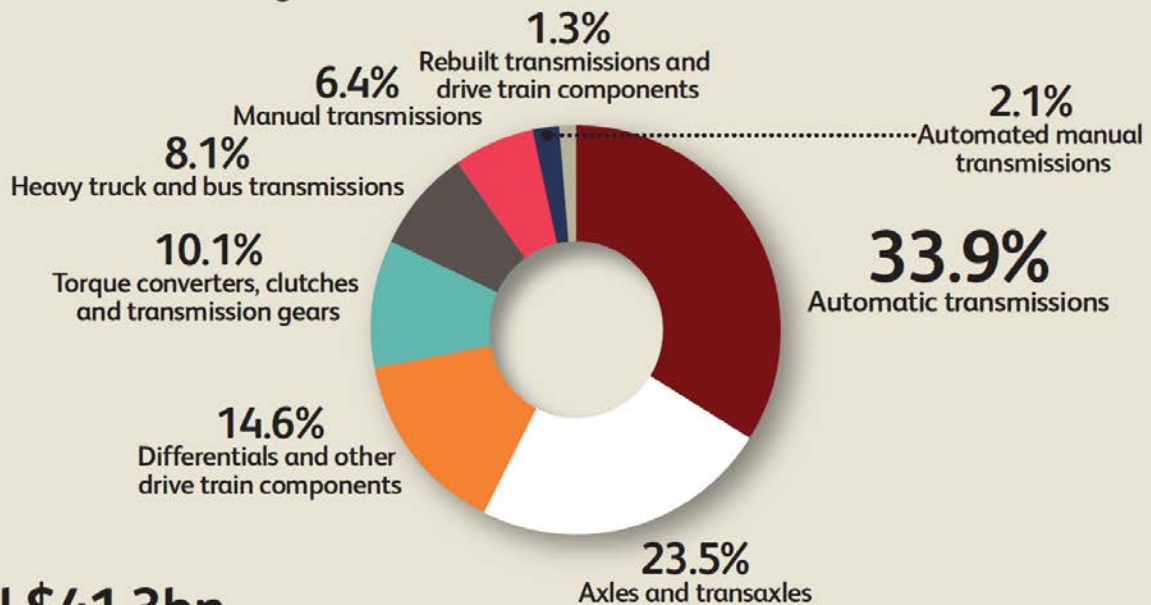


Total \$41.3bn

SOURCE: WWW.IBISWORLD.COM

Figure 1. Major Market Segmentation (IBISWorld Industry Report 33635) [3]

Products and services segmentation (2016)



Total \$41.3bn

SOURCE: WWW.IBISWORLD.COM

Figure 2. Products and Services Segmentation (IBISWorld Industry Report 33635) [3]

APPENDIX B - Magic Quadrant



Sources: CapIQ & IBISWorld

Figure 3. Magic Quadrant (CapIQ & IBISWorld)

APPENDIX C - Research Reports

The table below lists investment bank research reports and other research data we used. These reports are available through the Thomson One database through the UT Library system. If you would like further information on how to access these reports, please contact Loretta Wallace, the UT Austin Business Librarian, at UTBusinessLibrarian@lib.utexas.edu.

Research Firm	Report Name(s)	Date Published
Cormark Securities	Auto Components: Lots Of Growth At An Attractive Price	July 11, 2016
HSBC Global Research	Eaton (ETN US): Initiate at Buy: an outstanding self-help story	October 7, 2016
Susquehanna Financial Group	American Axle & Manufacturing Holdings Inc.: Initiating Neutral - Survive...Plant...Harvest	October 20, 2014
Susquehanna Financial Group	BorgWarner Inc.: Initiating Positive - Efficiency Defined	October 20, 2014
Susquehanna Financial Group	Magna International Inc.: The Jack of All Trades Attempting to Master Far More than One	December 23, 2015
Credit Suisse	BorgWarner, Inc.: When Fundamentals Converge with Expectations	August 13, 2014
Gabelli & Company	Linamar Corporation: Initiate with a Buy Recommendation	March 16, 2016
S&P Capital IQ	Dana Holding Corp	April 27, 2015
GlobalData	ZF Friedrichshafen AG - Strategic SWOT Analysis Review	November 2016
GMP Equity Research	Exco Technologies Limited	June 30, 2015
RBC Capital Markets	Allison Transmission Holdings Inc.: Initiating Coverage; Outperform	March 14, 2016
RBC Capital Markets	Martinrea International Inc.: Gaining Altitude After The Year Of The Launch	June 21, 2013
IBISWorld	Industry Report 33635: Automobile Transmission Manufacturing in the US	April 2016

Research Firm	Report Name(s)	Date Published
IBISWorld	Industry Report OD4919: Forklift Manufacturing in the US	September 2016
Societe Generale	Caterpillar Inc	June 2, 2015
Wright Investors' Service	Schaeffler AG	November 14, 2016
Minkabu	Twin Disc Inc	November 2016
New Constructs	Twin Disc, Inc. (TWIN)	November 12, 2016