

**Volume #13: Modernization of Things Areas of Interest**

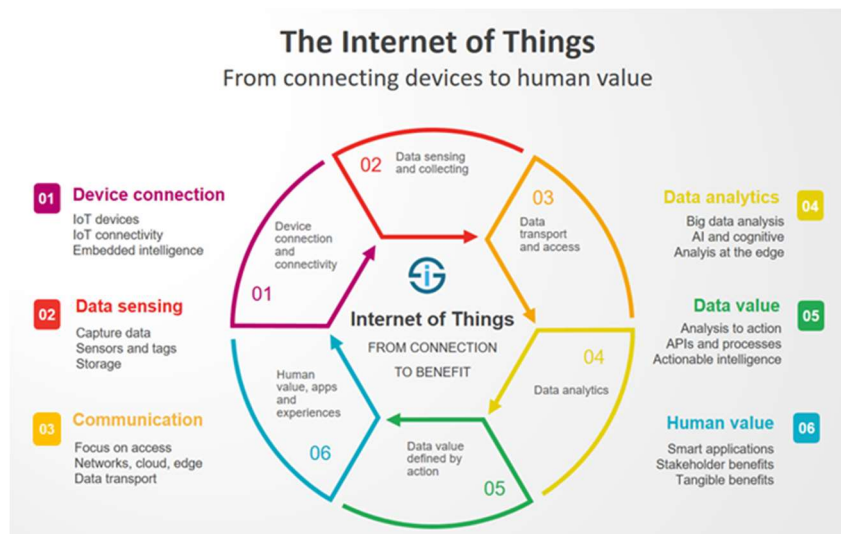
In the previous Strategy Report, 3RC discussed the most relevant areas of interest concerning the manifestations of *Lower Domestic Energy Prices*. In this report, 3RC will examine the most promising opportunities related to the manifestations of *Modernization of Things*. This investigation will further guide our investment strategy and outbound sourcing efforts.

The table below outlines the key areas of interest that 3RC will discuss in the following pages of this report. 3RC is tracking several sub-verticals that will continue to shape the wider thematic lens and will inform 3RC’s search to uncover the most compelling investment opportunities for our investors.

Factor of Influence	Manifestations	Areas of Interest
Modernization of Things	Overall productivity growth fueled by embedding technology into existing systems	<ul style="list-style-type: none"> <li>Technology infrastructure maintenance and installation services</li> <li>Technology infrastructure suppliers</li> </ul>
	Improvements in the Industrial base through use of the Internet of Things (“IoT”) and Artificial Intelligence (“AI”) for predictive maintenance and advanced problem solving	<ul style="list-style-type: none"> <li>Building and facility automation services</li> <li>Security implications and applications</li> <li>Advanced machinery automation providers</li> </ul>
	Increased infrastructure budgets and improvements in technology help to maintain and rebuild aging civil and energy infrastructure in the U.S.	<ul style="list-style-type: none"> <li>Energy efficiency products and services</li> <li>Specialty materials and contractors</li> </ul>

**Technology’s Industry-Agnostic Impact**

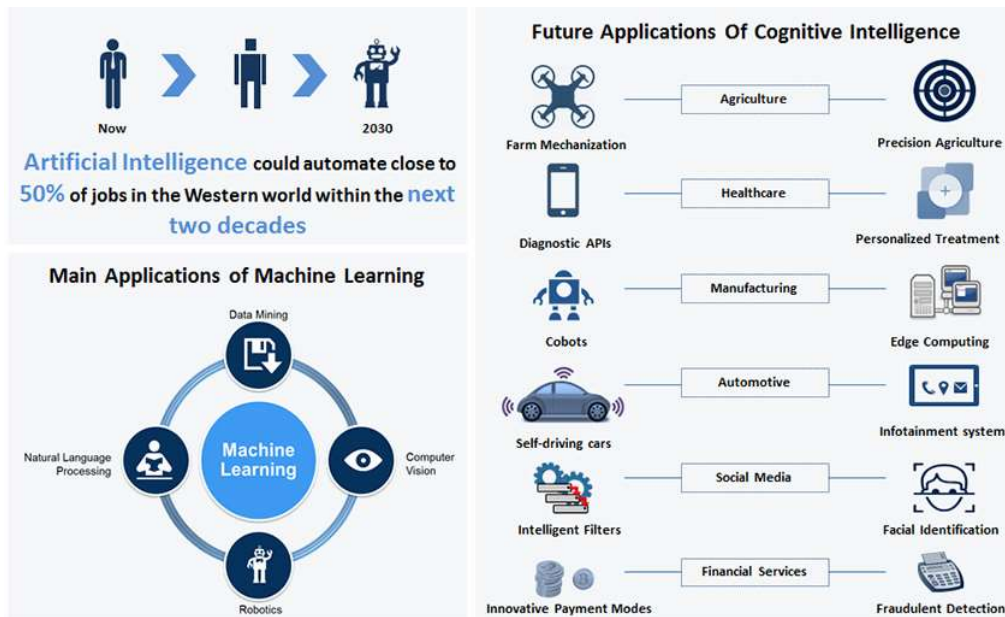
If the United States is to sustain strong growth in the upcoming years, it will be contingent on the implementation of technology and recognition of the potential that it entails. One technology of importance, the Internet of Things (IoT), grew 31% from 2016-2017 to reach 8.4 billion connected devices worldwide, and is projected to continue growing to reach 20.4 billion connected devices by 2020.<sup>1</sup>



Expenditure on IoT devices and services will grow in tandem, and is projected to increase to \$3 trillion by 2020 for consumer and business hardware, with IoT services spending representing only a \$237 billion market in 2017. Notably, IoT services expenditure is expected to grow faster than overall investment and has a projected CAGR of 15% through 2020.<sup>2</sup> In addition, the three industries that are anticipated to receive

the most IoT revenue in 2018 are “manufacturing (\$189 billion), transportation (\$85 billion), and utilities (\$73 billion),” each of which fall into 3RC’s investment framework, particularly when the service components are overlaid.<sup>3</sup>

Another emerging technology, Artificial intelligence (AI), along with AI-enabled tools, is expected to create \$2.9 trillion in total value for businesses by 2021, primarily through increased worker productivity, saving an estimated 6.2 billion-man hours.<sup>4</sup> Approximately 20% of employees who do non-routine work will, by 2022, utilize artificial intelligence in some capacity. 3RC is ushering in these new advancements by eagerly seeking ways to incorporate AI into our investment framework.



Anju Gupta, director of digital partnerships and outreach for Monsanto, noted that even if 99% of technology projects fail during development, the “exponential gain” brought by the 1% that succeed and are implemented is enough to change the direction and earnings potential of firms.<sup>5</sup> This has led to estimates from Goldman Sachs indicating that artificial intelligence in the agricultural vertical alone will account for approximately \$20 billion in cost savings annually.<sup>6</sup>

While the impact of technology is broad and cannot be overstated, 3RC recognizes that there is a significant amount of innovation risk when investing in technology companies. Rather than making direct investments in the companies that will be developing IoT or AI technologies, 3RC has identified industries that will implement these technological developments, primarily in the service and maintenance industries. Among those industries are: (a) building and facility automation, which includes security applications, (b) specialty maintenance services and installation, (c) technology infrastructure suppliers, (d) infrastructure materials and contractors, and (e) those providing methods to increase energy efficiency. These sectors will be examined in greater detail below to illustrate the opportunity set.

### IoT & AI in Manufacturing & Industrial Sectors

The implementation of IoT and AI processes within factories is proliferating rapidly, with a broad array of industrial companies finding AI and IoT solutions to be ideal for reducing production costs and improving margins. As a result, the industrial automation market is expected to grow at a 5% CAGR through the next five years to reach a market size of \$153 billion by 2022.<sup>7</sup> The value of the industrial IoT market alone,

which is distinct from the automation market, is expected to reach a startling \$11 trillion, as the technology can identify maintenance problems before they arise, leading to significant cost savings over the next 15 years.<sup>8</sup>

The textile and clothing manufacturing industry may serve as a road map for the value that can be created by adopting automated technologies as it was “among the first to be mechanized.”<sup>9</sup> Technology was initially implemented in the industry with electric sewing machines, though their impact was relatively limited compared to “robotic and computer-enhanced machine technologies,” as they still required workers to be heavily involved in the process. The new machines being used now, however, require less human involvement and are “automating even more complex and time-consuming sewing tasks.” H&M and Zara, two brands that are prevalent in the U.S., are now using machines that look like large printers in their manufacturing processes, with additional, similar factories for other brands opening in areas across the U.S.

Levi Strauss has recently implemented new technological advancements in the manufacturing process that creates “holes, fraying, and fading that give jeans a distressed look.”<sup>10</sup> This process usually requires significant labor costs, though laser-cutting technology developed since 2000 has helped cut down the manpower required. Although manpower could be limited, the laser distressing technology still required “some form of hand finishing,” which limited their value-add. New innovations, however, have eliminated the need for any manual labor for this process. In addition to eliminating labor costs, the new equipment has also reduced the finishing time from 20 minutes to 90 seconds, cut “the production and distribution cycle in half,” reduced the manufacturing steps from 20 to 3, and allowed for “last-minute style changes.” Most notably, however, the 15% of employees that are required for the finishing process will steeply decline because of the implementation of the latest laser technology, which is expected to make nearly all of Levi Strauss’ jeans by 2020.

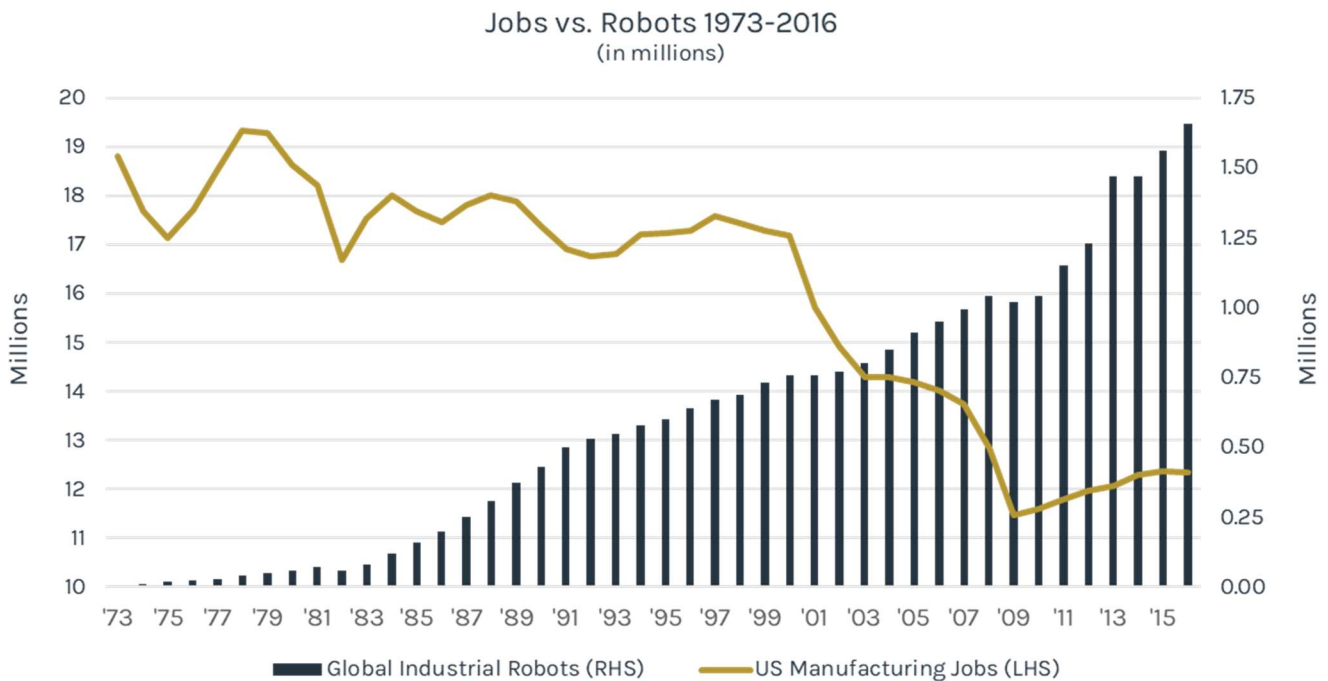
Reducing required labor will allow companies to significantly enhance their margins. Additionally, companies employing the latest technology will have the option of relocating their manufacturing operations to the United States or their desired end-market, as they will be able to focus on optimizing distribution rather than searching for the lowest cost of labor. This complements the wider thesis from the *Shifting Demographics* reports, which explained why low-cost labor may be less available in the United States in the coming years. As low-cost labor dries up, implementing the latest technologies will be critical for companies currently manufacturing in the United States to compete in a market with rising labor costs. Recently, 500 executives of companies with more than \$500 million in annual revenue were surveyed about the health of manufacturing in the United States. Seventy-five percent of those executives reported that “their companies are likely to expand manufacturing efforts in the U.S.”<sup>11</sup> We expect much of this new investment to be in the form of implementing recent technological developments to maintain or increase margins while also expanding capacity necessary to grow revenues. The companies that develop, implement, and maintain these innovative industrial applications will see incredible growth in the coming years.

Despite the incredible value created by the industrial automation industry, 3RC plans to avoid investing in the companies that build the machines themselves, preferring instead to focus on companies that install, service, and provide tangential support infrastructure for these applications. Companies that develop the machinery often carry significant technological risk, as improvements by their competitors can quickly drive them out of the market. The industries that 3RC will examine, however, are free of these exogenous factors as they should be capable of implementing and maintaining the adopted technology, whatever it may be. With this strategy, 3RC should be able to capitalize on its prior experience in the service industry while riding the wave of industrial automation, and thereby optimizing returns for its investors.

## Specialty Maintenance Installation & Services:

While estimates indicate that only 5% of occupations can be fully automated in the near-term, the roles that will be automated are those that are highly-structured and repetitive, which are “most prevalent in manufacturing, accommodation and food service, and retail trade.”<sup>12</sup> Others have estimated that 59% of manufacturing activities are susceptible to automation. The firms leading the charge on this front are likely to be more profitable in the near and long-term. Because of the increased use of these systems, the companies that install, maintain, and service these components are experiencing growth.

In fact, overall demand in the robotic manufacturing sector has been increasing rapidly, with North American sales in the first half of 2017 reaching \$1.0 billion, a 33% growth rate over the prior year.<sup>13</sup> More relevant to 3RC, however, is the maintenance of these components and the wider building infrastructure. The building maintenance service market size is approximately \$176.5 billion and is responsive to shifts in technology related to manufacturing, as installation and service will be required for the interchange of these units.<sup>14</sup>



Source: BofA Merrill Lynch Global Investment Strategy, IFR Statistical Department, US Bureau of Labor Statistics

Manufacturers produce incredible amounts of data, with as much of 72% of the data not used to drive further efficiencies in the process. Companies that can capitalize on this unused data can squeeze greater efficiencies from their operations than their competitors, which will allow them to build a defensible position in the market while also providing outstanding value to their customers.<sup>15</sup> While the IoT device makers who create the products that will allow manufacturers to use more of their data will experience rapid growth, 3RC is most interested in the predictive and specialty maintenance companies that help firms capitalize on the newly-utilized data. Again, there is less innovation-risk associated with those who provide services related to the adopted technology, but there is still enormous upside to those businesses. For example, the predictive maintenance market is expected to grow at a 24.8% CAGR through 2021, reaching a market size of \$4.9 billion.<sup>16</sup> The value provided is clear, as it could reduce the \$20 billion in unscheduled downtime that accounts for 5% of total output value.<sup>17</sup>

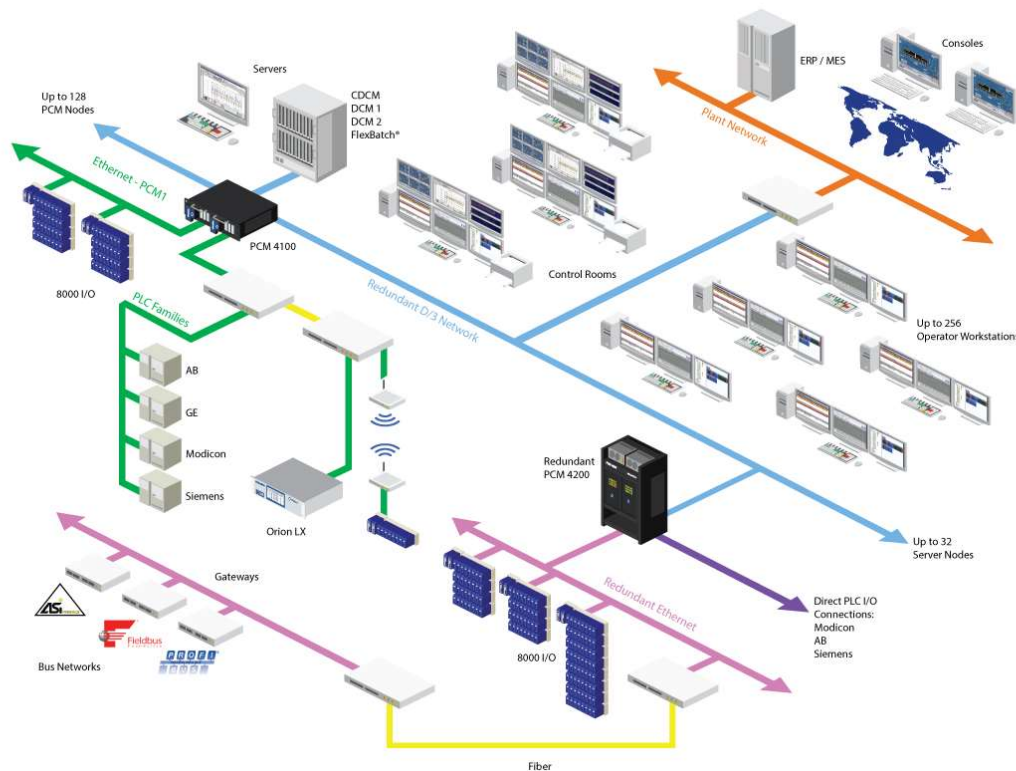
In another example, and as we discussed in the manifestations of *Modernization of Things*, the colocation data center market is expected to grow at a 13.4% rate through 2021 to reach a market size of \$25.4 billion.<sup>18</sup> The primary trend driving this growth is the desire for small and medium-sized businesses to store data and avoid the initially high capital expenditures associated with the construction of private data center solutions. For 3RC, the maintenance, service, and construction companies that support these facilities are attractive due to the large amount of recurring revenue which increases predictability of sales.

Finally, 3RC finds the installation market interesting as well. The testing, inspection, and certification services industry is expected to grow at a 6% CAGR through 2024, reaching a total market size of \$285 billion.<sup>19</sup> These services play a role in several industries, which can include the testing of materials for construction, assuring that software works as requested, and testing the reliability of emergency components in buildings.

M&A activity in the maintenance industry has been strong in the past few years, with over 75 transactions being completed in 2017 and 41.6% of volume coming from PE buyers.<sup>20</sup> Due to the large amount of capital available to PE firms, the premium usually given by strategic acquirers from synergies has been matched by financial buyers as well.

**Technology Infrastructure Suppliers:**

One market trend that 3RC is closely following is the impact of distributed control systems. Essentially, in these systems data is gathered and communicated through sensors and microprocessors at strategic locations in an industrial facility, and are “most suited for large-scale processing or manufacturing plants wherein a large number of continuous control loops are to be monitored and controlled.”<sup>21</sup>



Specific components of these systems interest 3RC, including process control units which gather and analyze the data, communication systems that connect the sensors with various stations across the facility, and the smart IoT devices that perform the gathering of the data itself.

Specific verticals where distributed control systems will be implemented most heavily are the oil & gas and electric power industries, where 3RC has invested in and strategically advised companies in the past. Additionally, manufacturing operations management, and manufacturing execution systems are receiving increased investment by manufacturing facilities to improve margins through cost reduction. Technology has made this process easier by increasing the amount of data that can be used to achieve cost-efficiency goals. From resource allocation to process management, manufacturing execution systems integrate into nearly every aspect of a facility and infrastructure will need to be put in place to support each individual component.

The sensor market provides the technological infrastructure necessary to capture the data required for increased efficiency and is projected to grow at 11.3% through 2021 to reach a market size of \$241 billion.<sup>22</sup> The most enticing companies for acquirers are those that offer highly-advanced sensors and technology to their clients, though these businesses usually receive premium multiples as well. Investing in highly advanced sensors incorporates the same technological risk mentioned previously, though the firms that install these sensors can still be insulated from many of these issues. Value-added distributors that operate in the sensor market can purchase existing effective technologies and add additional technology to provide an improved automation solution.

Another area showing promise is the interconnected components industry, which tangentially supports and is integrated into almost every manufacturing business. This industry includes items from cables to industrial connectors for sensitive electronics. The primary trend driving strong growth in the space is the increase in data collection that requires transmission to be interpreted, necessitating the use of connectors. Moreover, as the number of buildings continues to rise, and the technology required by current buildings increases, the industry will experience a distinct shift in demand. Many of these components operate in a market like that of a commodity, which limits profitability for those companies. Instead, 3RC is examining the installation and implementation of the interconnected components industry which, due to the value created by their services, provides for higher levels of profitability.

M&A activity in the space has reflected this growth through consolidation, with an estimated 50 transactions occurring in 2017.<sup>23</sup> A high percentage of transactions in the past years have “involved strategic buyers with companies providing products and solutions related to automation, connectivity, and sensing generating the most interest.”<sup>24</sup> Notably, manufacturers have placed an emphasis on acquiring systems integrators, as they can be a channel for distributing their products.

### **Embedded Technology**

As AI and IoT technologies are implemented in a wide range of companies, they will fundamentally shift the investment thesis that 3RC uses. At the most basic level, IoT components will be installed into buildings to better monitor the operations of the buildings themselves. This can have multiple uses, as it allows for the supervision of critical components in the facilities and can even reduce costs by reducing power expenditure. Additionally, buildings that have enhanced building automation systems installed will provide the opportunity to improve the building’s security, which as we discussed in our *Escalating Conflicts* series will become extremely important in the coming years. The building and facility automation segment therefore rests within a key cross-over in the strategy report series, as it allows for exposure into both industrial and security improvements.

**Building & Facility Automation:**

In recent years, an increasingly large number of demands have been placed on buildings and facilities, and “a modern building is expected to provide a number of services with high security, energy efficiency and convenience.”<sup>25</sup> Operators have been eagerly adopting technology-enabled products and services due to their ability to facilitate completion of these complex tasks. These products include building automation systems, which are typically “a network of control devices that govern the operation of diverse types of electrical and mechanical systems ranging from heating and cooling to access and surveillance.”<sup>26</sup>



One example of a successful building automation project comes from a 78-unit residential building which was completed in 2014.<sup>27</sup> In addition to standard low-cost mechanical upgrades, the owners chose to add a building automation system to further improve efficiency and margins. These improvements included a “web-accessible automation system, intelligent boiler control algorithms, temperature sensors in suites and garage, [and a] snow sensor to control snowmelt system.” After implementation, which cost \$22,100, the owners reduced their facility management costs by \$15,000 annually, implying a 1.5-year payback period. While this is substantial, further components could be added to these systems in the future as the base building automation infrastructure is now in place. For example, cameras, door and light controls, and sensor-based alarms could be installed which would reduce the potential for a security breach.

With building automation systems being rapidly adopted, companies that specialize in the installation, management, and maintenance of these systems are growing rapidly. These companies are able to

position themselves as consultants to the building manager and can draw on a suite of existing technologies to provide a custom solution for each building's needs. Accordingly, they can charge a higher price than the typical equipment installer. These value-added distributors and specialty contractors are building a defensible niche within the market by tailoring their solutions to specific industries or sectors that require highly unique solutions. Specialty contractors, in addition, can win maintenance contracts as well, which helps transition them from simply being contractors to solutions and service providers. The revenue brought from maintenance contracts helps these firms reduce risk, as they can supplement one-time revenue opportunities with multi-year recurring contracts.

These value-added resellers, which aggregate multiple solutions to provide a more holistic service offering to their customers, are also highly dynamic. By implementing various components, these companies can change along with the technology and can continue to maintain systems by updating them with new technology as well. Moreover, a proprietary solution can be created that supports the monitoring of the system. For example a software platform can give the company defensibility against their competitors and allow the company to provide a higher level of service.

Some of the primary drivers for the building automation systems industry are environmental legislation, energy prices, and additional cost structure challenges. The cost of implementing systems has fallen as communications and networking technology costs have decreased even as available bandwidth has increased. Processing and storage costs have experienced a similar shift, with shrinking costs but processor complexity and storage size are improving. Within the implementation and maintenance market, demand "is being fueled by more stringent legislation on aspects such as air quality [and] energy use," and the potential to "save on the order of 20% in energy costs in commercial buildings."<sup>28</sup> Moreover, the ability to access data to monitor the system has allowed maintenance companies to address problems before they arise. These positive trends feed into 3RC's existing search within the building automation space.

The wider impact of big data on several industries is only expected to expand throughout the coming years, and the implementation, building, maintenance, and wiring of data centers will be the primary beneficiaries of this strong growth. Companies in the data center maintenance market, for example, provide a vital value-add to their clients by managing several aspects of the facility to ensure that the equipment and services within the facilities continue to operate efficiently and as intended. Overall, the data center services market is projected to reach \$77.5 billion in 2022, growing at an annual rate of 14.3%.<sup>29</sup> A few of the services that these companies provide include optimizing the use of power and cooling systems to reduce costs, ensuring that adequate backup power is in place to prevent outages, and cleaning services which monitor the air particle count to prevent hardware damage. Outages themselves can cost data center companies \$11,000 per minute, and the average outage time is 90 minutes.<sup>30</sup>

These components can be critical when improving the bottom-line of data center companies. The EPA found that a data center's power costs can amount to 30% of the IT budget, with most data centers using far more energy than is required.<sup>31</sup> This means that poorly operated data centers consume too much power at certain times, which leads to overheating, and being forced to boost the use of cooling systems which requires even more power, wasting a significant amount of money. This becomes even more important because data centers utilize specialized cooling systems, which include room-based cooling and rack-based cooling, which are vital to ensure that costly malfunctions are avoided but require a significant energy expenditure. Installation and maintenance companies that can optimize power consumption will be strong targets for 3RC.

The M&A market will reflect these trends, and manufacturers are being pressured into automation investments. In fact, "companies that operate in data analytics, Internet of Things (IoT) technology and



automation particularly [are] receiving increased interest from potential buyers.”<sup>32</sup> Profitability in terms of EBITDA margins expanded by 0.8% to 14.1% in 2017 relative to the 2014-2016 period, showing that firms are creating strong relationships with customers and building defensibility.<sup>33</sup> As the market continues to mature and firms establish a strong foothold in unique sub-verticals, specific companies will rise as leaders in their respective segments.

One-way 3RC could establish a presence in the industry is by acquiring a company that operates on the front end of the data center market, or another similar market that is expected to experience strong growth rates, by managing the construction of the facilities. The data center space is one area that has appeared particularly unique to 3RC and could prove to be an excellent candidate for a platform acquisition due to their ability to capture strong sales through a condensed customer base.

### Security:

Due to the rise in conflicts globally and the potential for security breaches to occur at any moment, companies that provide and support security technology are growing as well. In this sector, the trends of the *Escalating Conflicts* report are relevant as well, presenting an attractive investment thesis. Accordingly, 3RC has modified its search within the *Escalating Conflicts* theme to focus on conflict-related industries that also can benefit from modern technological innovations. The search process has already yielded targets in the space, and the deep analysis of the two industries will help 3RC uncover promising opportunities.

Value-added resellers in the security space are projected to benefit from the increased use of security related products. Managed service providers that handle security operations for facilities and utilize new technological advancements are positioned to grow revenue, as they can improve efficiencies in operations and increase the overall quality of service. 3RC will not, however, invest solely in a security company like ADT, but will focus instead on niche installation, maintenance, and service companies that support the industry.

M&A activity within the security solutions industry is elevated, with over 112 transactions in 2012 and 41.1% of value coming from financial buyers.<sup>34</sup> The fragmentation in the industry is advantageous to 3RC, as we should be able to acquire companies with niche service offerings that take advantage of technological improvements and develop and grow these companies using 3RC’s operational experience to position them for an acquisition by a strategic acquirer, prompting strong multiple expansion.

### **Infrastructure Refurbishment**

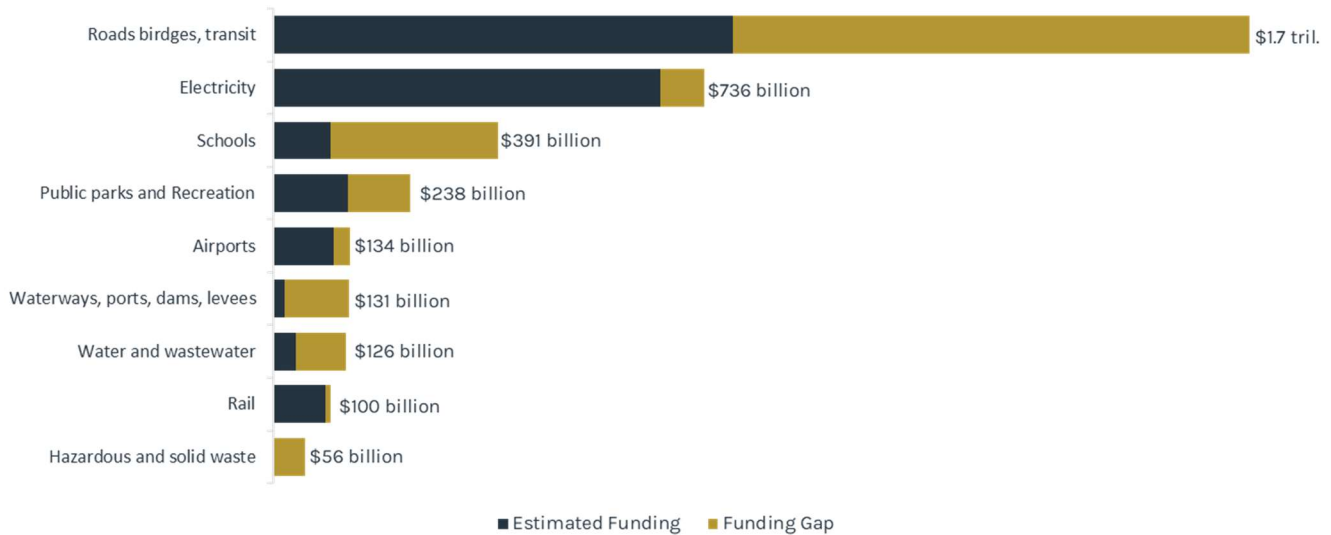
While the report thus far has primarily focused on technology, including IoT and AI, the modernization trend is not limited to these specific verticals. As discussed in the *Manifestations of the Modernization of Things* report, another area that falls under the umbrella of modernization is the improvement of infrastructure within the United States. Notably, however, the modernization of infrastructure does not necessitate the use of technology, as it encapsulates the entire range of industries that updates infrastructure. While there may be technology advancements in energy or material sciences which could play a role in the infrastructure modernization process, not all segments will be impacted.

The necessity for significant infrastructure spending by the United States, specifically in the maintenance segment to reduce future infrastructure expenditure, is an area of focus for politicians in 2018. The American Society of Civil Engineers, or ASCE, annually reviews U.S. infrastructure and consolidates their feedback in a digestible report card. For 2017, “America’s Cumulative Infrastructure Grade” was a paltry D+, which is the same score as 2013, and with rail being the only component receiving higher than a B-score.<sup>35</sup> Notably, the 10-year infrastructure gap has widened to reach \$2.0 trillion, much of which will need to be spent by the government.



While the infrastructure refurbishment segment includes both civil and energy infrastructure, the primary focus of this segment is civil infrastructure, which is in the crosshairs of 3RC’s current search process. Moreover, energy infrastructure was discussed at length in the *Areas of Interest* report regarding *Lower Domestic Energy Prices*, and earlier in this report when examining building automation.

Public Infrastructure Has Been Neglected  
Infrastructure needs, funded and unfunded, 2013-2020



Source: American Society of Civil Engineers 2013 Report Card for American Infrastructure and Failure to Act series, published 2011-2013

**Energy Efficiency:**

Within the energy and technology overlap, the energy efficiency market is projected to grow at 19% through 2027 with an increasing amount of revenue being sourced from municipalities and government entities. In turn, the market is expected to reach a size of \$3.5 trillion by 2026.<sup>36</sup> The market size for smart lighting is projected to grow to \$19.5 billion by 2022 with a CAGR of 27.1%, a massive growth rate indicating strong

recognition of demand by customers.<sup>37</sup> One unique infrastructure advancement within energy efficiency is urban lighting, as several companies are beginning to implement LED technology as a “sustainable, environmentally-friendly, and cost-efficient means of lighting.”<sup>38</sup> As part of the larger smart city trend, wireless monitoring and IoT technology allows lights to be automatically and remotely controlled to cut total electricity use and reduce municipal costs.

Additionally, smart lighting is impacting commercial customers, with indoor lighting providing a strong value-add for many businesses. The ability to automatically determine when lighting should be used based on the presence of individuals, time of day, and even amount of natural light all help reduce energy costs. Demand will also increase from drivers outside of energy efficiency, and escalating conflicts will necessitate increased control of lighting. If an intruder were to break into an office building or school, for example, the ability to have control over lighting in specific building areas could be used to track the intruder or reduce the intruder’s vision limiting the intruder’s capacity to cause damage.

### Materials & Contractors:

When the modernization of infrastructure occurs, it will rely heavily on contractors to build out the infrastructure itself. These contractors will require specific materials that will be used within the infrastructure, making both the materials and contractor industries areas of growth. While infrastructure will be modernized, the upgrades will not necessarily incorporate anything other than fairly traditional, non-technology products and services.

One area of focus that fits this framework is the road maintenance supplies industry which includes asphalt, safety equipment, and machines that build the roads themselves. The road and highway construction industry currently has revenue of \$128.1 billion and has grown at 3.6% over the past five years.<sup>39</sup> Additionally, the bridge and elevated highway construction industry currently has revenue of \$18.0 billion and is projected to grow steadily over the next five years. Companies that are best positioned to efficiently provide the correct materials and service will be targeted in 3RC’s search. Moreover, contractors that utilize technology to maintain roads and infrastructure should be more efficient in their planning and analysis, giving them the ability to manage a larger number of projects overall. This will allow these firms to differentiate themselves among other asset managers and win bids over competitors.

Additional areas in which 3RC will continue searching in the coming months include line striping, safety, and traffic control. The industry that includes the painting of lines on roads and bridges has revenue of \$36.8 billion and is expected to grow through 2022.<sup>40</sup> When construction increases in the U.S., there will be an increase in the amount of traffic diversion products and services as well, making this industry an interesting tangential play. The alarm, horn, and traffic control equipment industry is at \$4.9 billion in revenue currently, although, most notably, it is projected to grow at a rate almost double the line striping industry annually over the next five years after shrinking by 3.5% annually from 2013-2017.<sup>41</sup>

Another unique element of the industry is the development of flexible infrastructure that can incorporate further advancements in other areas of technology. One of these innovations is driverless cars, which are on the roads here in Pittsburgh but have yet to expand across the nation. Interestingly, “developers are starting to build offices with internal parking structures that can be converted into office space if demand for private parking decreases” as a result of the increased use of autonomous vehicles.<sup>42</sup> This has led to the term “future-proof,” which is an attempt to design infrastructure that will be insulated from obsolescence and defend profitability. It has become even more critical for developers to focus on future-proofing infrastructure as “many of the structures and streets they’re designing will still be around decades from now.”<sup>43</sup> These changes are not limited to driverless cars, however, and those companies within the broader infrastructure landscape will need to focus on these aspects to adapt to changing market dynamics.

Our belief that technological innovation and modernization will be leading drivers of economic growth in the near to medium-term has led 3RC to focus on three specific industries of interest: (1) IoT and AI and related businesses, (2) embedded technology applications, specifically building automation services, and (3) civil and energy infrastructure improvement and maintenance. 3RC is prepared to uncover the most promising investments that relate to the trends discussed in this report. This is the final substantive report 3RC will be releasing in this series. Next month's volume will summarize our investment strategy reports to date and provide a roadmap for future reports.

## **SOURCES:**

<sup>1</sup> Gartner

<sup>2</sup> IDC Research

<sup>3</sup> IDC Research

<sup>4</sup> Gartner

<sup>5</sup> Wall Street Journal

<sup>6</sup> Goldman Sachs

<sup>7</sup> Markets and Markets

<sup>8</sup> Manufacturing Business Technology

<sup>9</sup> Wall Street Journal

<sup>10</sup> Wall Street Journal

<sup>11</sup> Wall Street Journal

<sup>12</sup> McKinsey

<sup>13</sup> Association for Advancing Automation

<sup>14</sup> Freedonia

<sup>15</sup> Gartner

<sup>16</sup> Markets and Markets

<sup>17</sup> Stratus

<sup>18</sup> IBISWorld

<sup>19</sup> Transparency Market Research

<sup>20</sup> Capstone Partners

<sup>21</sup> Electrical Technology

<sup>22</sup> Allied Market Research

<sup>23</sup> Capstone Partners

<sup>24</sup> Clearwater International

<sup>25</sup> Chalmers University of Technology

<sup>26</sup> Johnson Controls, Inc.

<sup>27</sup> Watershed Technologies, Inc.

<sup>28</sup> Johnson Controls, Inc.

<sup>29</sup> IBISWorld

<sup>30</sup> Ponemon Institute

<sup>31</sup> EPA

<sup>32</sup> Capstone Partners

<sup>33</sup> 7 Mile Advisors

<sup>34</sup> Capstone Partners

<sup>35</sup> ASCE

<sup>36</sup> Persistence Market Research

<sup>37</sup> Markets and Markets

<sup>38</sup> NetworkNewsWire

<sup>39</sup> IBISWorld

<sup>40</sup> IBISWorld

<sup>41</sup> IBISWorld

<sup>42</sup> Wall Street Journal

<sup>43</sup> Wall Street Journal