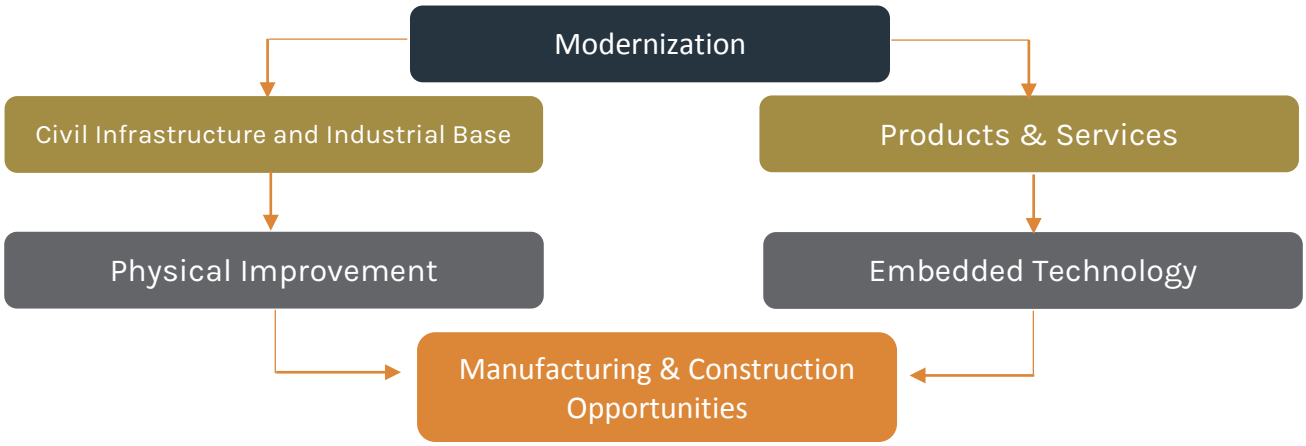
Volume #5: Modernization of Things

Key Summary of Findings:

- Smart technology is already embedded and will continue to blend with society, creating product autonomy, improved safety, and enhanced efficiency.
- Big Data, robotics, 3D printing, crypto currency, IoT, and connectivity influences will vary across industries, but will integrated into all top U.S. industries of the future.
- The Internet of Things is happening now and will grow rapidly over the next 10 years, reaching 50 billion connected devices globally by 2020[1].
- Future U.S. Industries will grow with technology adoption, driving growth in manufacturing, information, and services industries.
- Shifts in U.S. manufacturing are pushing gains in cost, timing, and production efficiencies that will allow manufacturers to be more nimble and adaptable to increasingly rapid market shifts and niche market needs.
- Energy investment will be the biggest driver of construction growth, which is changing the composition of States expected to have the largest construction growth.
- Construction will be a $953 billion market by 2020, with expansion stemming from growth in domestic oil and gas production[2].
- Consolidation and commodification of construction services are changing the industry's landscape and driving innovation in technology and energy efficiency.

As a continuation of our discussion related to factors of influence that we see shaping the investment landscape over the next several years, we would like to delve into our last important factor, "*The Modernization of Things*". This factor is very far reaching and one that can be viewed through many different lenses. Some segments of the U.S. economy will drive the *Modernization of Things* through the development and application of new and advanced technologies. While these new technologies may be attractive to some investors, they do not fall within our investment criteria because of the difficulty in measuring the risks associated with ever developing technologies. While a direct investment into a technology company is highly unlikely, an investment into a company that leverages the trend of embedding technology into an already established business that makes their product or services more efficient and cost effective would be. In addition, the expected increase in capital expenditures dedicated to the improvement and automation of both the civil infrastructure and industrial base would be of particular interest. The following graphic illustrates our perspective on this factor of influence and from which we will structure our discussion.



As illustrated in the graphic above, 3RC's perspective is that modernization will occur in two ways that we plan to research further. First is the physical improvement of the civil infrastructure and the industrial base and second is the application of existing technologies that will improve the efficiency of products and services.

Future U.S. Industries Will Grow with Technology Adoption

Technology is driving U.S. growth in the manufacturing, information and services industries. Manufacturing as a whole makes up the largest U.S. sector, followed by finance and healthcare. Reshoring, intellectual property protection, and highly specialized manufacturing techniques will drive growth in the manufacturing sector.

Chemical manufacturing will be among the largest and fastest growing manufacturing sectors. This subsector is characterized by focus on higher margin, niche products. The U.S. is expected to be the next petrochemical hub by 2020, driven by the shale gas boom and low cost natural gas feedstock. Investments in the 10 largest U.S. chemical manufacturing plants through 2017 will produce more than 8 million tons/year of petrochemicals, intermediates, fertilizers, and gas liquids[3]. Growth is expected to be driven by specialty chemicals and chemical manufacturing with niche, differentiated products such as catalysts, special polymers, agrochemicals, electronics, biofuels, and bioplastics.

Shifts in U.S. manufacturing are pushing gains in cost, timing, and production efficiencies that will allow manufacturers to be more nimble and adaptable to increasingly rapid market shifts and niche market needs. 3RC sees five major trends that will drive the transformation shifts in U.S. manufacturing.

Localization

Lower automation and 3D printing costs, a stronger need for intellectual property security, and rising shipping costs propel end consumers to seek local manufacturing capabilities. Local manufacturing will improve local brand value, rapid prototyping, small batch flexibility, speed to market and environmental sustainability.

Harnessing Big Data

Big Data refers to a collection of data from traditional and digital sources inside and outside a company that represents a source of discovery and analysis. Big data consists of different types of technologies that work together to extract value from data that would have been previously considered unusable to improve processing, efficiency, and yields.

3D Printing

3D printing reduces carriage and component costs and allows for faster, less expensive prototyping with reduced waste. 3D printing allows everyone to be a manufacturer, while shifting manufacturing from a push to a pull supply chain. The category will evolve from rapid prototyping tools to mass manufacturing tools by 2025.

Robotics and Knowledge Work Automation

These technologies will improve speed, precision repetition, productivity and accuracy, while reducing labor costs, handling of hazardous materials, and accidents. The U.S. is an early adopter in robotics, which is expected to contribute to reshoring of manufacturing output in the U.S. However, robotics will likely replace low-skilled jobs, not bring them back.

Predictive Analytics

Manufacturing plants will gather and analyze data to continuously update workflow, predict maintenance, and simulate multiple scenarios and market movements. Analytics reduce risk and cost for manufacturers, while helping direct production toward future needs.

The Emergence of the Internet of Things (IoT)

Over the next 10 years the Internet of Things will become pervasive. The IoT is already happening and will grow rapidly, reaching 50 billion connected devices globally by 2020[4]. The IoT will be the infrastructure by which connectivity penetrates industries and daily life, enabling the development of new products and services as well as the collection of vast amounts of data on business processes and consumer behaviors. The IoT incorporates network connectivity into everyday objects, driving an evolution in the way humans interact with technology and the world. Eventually every object will have a unique identification and the ability to connect with and transfer data to other objects, adding another dimension to the world of information and communication technology.

IoT will create new opportunities for growth, as embedded sensors connect to wireless networks to automate and improve processes across industries and daily life. Smart technology adoption will start in major cities that will become known as "Smart Cities" which invest in smart technologies to improve citizens' lives. Energy will become more efficient, reliable and sustainable. Mobility will increase through reduced congestion and emissions, and increased public transportation use. Buildings will have automated HVAC, plumbing, lighting, and mechanical processes. Civil infrastructure will have more efficient roads, bridges, water distribution, and waste management. In factories we will see operations optimized through predictive maintenance, inventory optimization, and health and safety monitoring. Sensors and data analytics can provide valuable insights into customer behaviors that can be used for layout optimization and personalized in-store promotions in the retail industry.

Shifts in Construction Industry will be driven by Innovation

Consolidation and commodification of construction services are changing the industry's landscape and driving innovation in technology and energy efficiency. The trends driving the future of the construction industry include industry consolidation, technology innovation, modular construction, energy efficiency and large business dominance.

Vertical integration of design and building companies has been a trend for the last decade. Current building information modeling adoption rates by architects and contractors are currently above 70% versus rates below 30% just 10 years ago.[5]

Trends toward the use of robotics equipment, virtual reality, advanced materials, 3D printing all contribute to significant improvements in efficiency. Today, robotic equipment improves efficiencies by at least 30%, with the trend towards 50% within 5 years and over 100% expected in 10 years[6].

Modular construction provides for movable components for low costs size scalability and increased flexibility without the need for large capital expenditure outlays. Modular construction can save as much as 30-40% on materials and labor[7].

Energy efficiency in the construction industry lowers building and operational costs while reducing energy emissions. New environmentally friendly materials such as *Green Concrete*, *Green Paint*, *Green Insulation* and *Green Flooring* are all becoming commonplace in construction, which provide ever

increasing energy saving incentives of 10-13% on an annual basis .

Large construction firms are gaining a larger proportion of the industry revenue through bidding strength and cost efficiencies, emphasizing the need for greater specialization of small contractors. Data supports this assertion as 1/3rd of all start-up construction businesses fail within 2 years, while the majority of others provide a niche or specialized service that eventually is targeted by several large industry consolidators seeking to expand their own capabilities to keep up in a highly competitive market.

Changing Buying Patterns
American shoppers will increasingly purchase products anywhere and anytime due to omni-channel retailing, which will require retailers to create a consistent experience across traditional and online stores. Customers' purchasing needs are evolving as well. Customers now expect instant gratification, are accustomed to convenience, expect products to be user friendly and expect optimal pricing. These demands are leading retailers to reduce delivery times, implement digital storefronts that allow for on-the-go, quick ordering, in-store automation and self-checkout, and implementing location based sensors targeting users' smartphones with instant discounts and promotions.

Technology Evolves Learning Methods
Blended learning and open educational resources will develop as learning strategies evolve to create new uses of established and developing technologies. Learning styles, paired with evolving teaching methods, will create a need in the classroom for already established and new technologies that will give students the skills they need to be competitive in a technologically advancing world.

Today's students are made up primarily of Millennials and Post-Millennials who have a much different perspective on learning because they always had technology as part of the lives. The idea of going to the library to find research to write a paper is obsolete. Today's student doesn't learn just in a classroom or library, they have the tools now to learn anywhere. Today's student doesn't laboriously curate answers to questions by looking them up in a book, they have questions answered instantly via Google search. Today's student doesn't have to attend classes to get a college education. They can go online to attend their Master's classes. To react to the shift in learning capabilities, teaching styles are evolving to meet the needs of the millennial habits by implementing new tools and restructuring curriculums to better meet the demands of the 21st Century.

What does this all mean to 3RC Investors?
In 2017, 3RC will continue its study of this factor of influence by focusing on all of the implications that may arise. This factor of influence is one that is broad and far reaching so it will be essential to narrow our focus by identifying areas of the market where our perspective and expertise can be leveraged. As mentioned, while much of this factor of influence is driven by technology, we are not technology investors. We simply will be looking for manifestations that may occur in our areas of expertise that are being driven by existing technology implementation. For some industries, the technological *Modernization of Things* will create a once in a lifetime boom period, while for other industries the same technologies may spell the end.

Additionally, we think that the modernization of physical assets is both required and inevitable, thus creating opportunities in the construction and building sectors that support infrastructure renewal. This renewal will be focused on both civil and energy infrastructure, areas in which we have expertise already.

SOURCES:

1- *Frost & Sullivan*
2- *U.S. Labor Department*
3- *Wall Street Journal*
4- *IC Insights*
5- *U.S. Bureau of Labor Statistics*
6- *"The Future of Employment" Oxford Martin School*
7- *U.S. Green Building Council*