

# Rise of the Robots

## Analysis of Robotic Advancement

### VS.

## The Future of The Workforce

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#### Abstract

**Purpose** – To describe the future of automations and computing, and how it is currently effecting the job market, and what the future holds for the blue-collar, and white-collar workers.

**Design/methodology/approach** – From twenty articles, most of which include data that that are examined using content analysis. The analysis includes the examination of public predictions for the future of workforce automation, industrial robot market, and future of the industrial robotics market

**Findings** – The results show evidence that United States is not as advances in Industrial Robotics as other countries. China is working on replacing have of its workforce with robotics under a project called “replacing humans with robots.” Our generation will be the generation of the ‘Robotic Immigrant’, and our grandsons will be called the Natives of Generation ‘R’. A world dominated by automation is inevitable, and how we react to that is our own choice.

**Research limitations/implications** – This study represents a snapshot in time. Neither culture Nor technology options are static. As a result, future work in this area should examine these changes.

**Practical implications** – Since only a few dimensions of the work fields are dominant in the sample, results suggest that blue-collar workers need to get a degree, and find a way to move up the chain.

**Originality/value** – This paper provides evidence that computing and robotics are more reliable that humans, and automation is the future that will take over the underclass work positions

**Keywords** Robots, United States of America, Automation, Blue-Collar Worker, China, IR, Exponential Growth, Industrial Robotics, White-Collar Worker, Generation ‘R’, Native Robotic

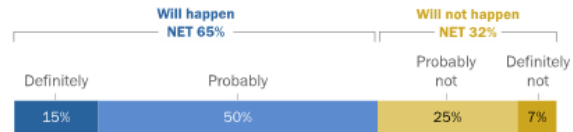
**Paper type** Research paper

## 1. Introduction:

“Industrial robotics is the technology used to automate a variety of manufacturing processes across different industries such as automotive, food and beverage, and electrical and electronics. Industrial robots are programmed to automate and control manufacturing processes such as arc welding, spot welding, materials handling, machine tending, picking, packing and palletizing, assembly, mechanical cutting, grinding, deburring and polishing, gluing, adhesive sealing and spraying materials, and other applications including inspection, water jet cutting, and soldering” [3].

### Two-thirds of Americans expect that robots and computers will do much of the work currently done by humans within 50 years ...

% of adults who say that in the next 50 years robots and computers will do much of the work currently done by humans



### ... but most workers expect that their own jobs will exist in their current forms in five decades

% of workers who say the jobs/professions they work in now will/will not exist in 50 years

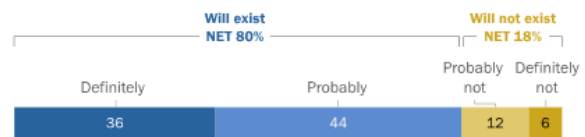


Figure 1: Survey results done by Pew Research Center [2]

Within the past decade, the amount of money spent on industrial robots has more than doubled from \$5.2B in 2005 to 11.6B in 2015, and is expected to reach 24B in 2025 [1]. The first mass produced industrial robot can be traced to 1961, it was called Unimate 1900, which was a robotic arm that transported die casting in automobile manufactures assembling line and fusing these parts to auto bodies. This advancement in its time was enormous as it took out the human element from this part of the assembly, which used to lead to poisoning in some cases due to toxic chemicals that are used in the process. “As a result of the Unimate, the field of robotics continues to expand beyond manufacturing to virtually every facet of human life and service.” [8]

This advancement opened a new field in the industry and raised the questions of what can be done next and how will it affect the job market? As we can see every year the technology jumps exponentially, and giving the huge projects that are being done in the fields of robotics and automation, I would say their impact on the future will be extraordinary; just last week Uber said they plan to start testing flying cars within three years [6]. And with such advances, there will be a need to create new technology and infrastructure that no one can imagine as of yet. Based on a survey that was conducted among 2,001 american adults shows that 65% of them believe that robots and computer will take over their jobs within the next 50 years as can be seen in Fig. 1. [2]

Therefore, the purpose of my study is to examine the influence of various factors on the future of the workforce, and the world we live in. Specifically, I seek to determine:

- Where is the future of robotics heading, and what are the downsides and upsides of it?
- How computing advancement is going to play a major role in the future of robots
- What is Generation 'R', and how is it interconnect with our future?
- What does the future hold for the white-collar and blue-collar workers?
- The future of driverless cars

## **2. Literature Review:**

### **2.1. Future of Robotics**

Since the production of the first industrial robot in 1961, we can see that all of the robots invented since then share common characteristics: the speed of the robots (every new robot that is developed one of its main characteristics is that it is way faster than its predecessor), accuracy, and efficiency. Evolution of robotics which includes all the data, innovations, and available technology, can be summarized into four waves of what is called Robotic Revolutions (RR) that also includes a holistic view on the next 60 years of automation [7], also can be seen in Fig. 2:

#### **2.1.1. Robot-Based Automation Solutions**

After the first industrial robot was launched in 1961, it grew in a fast rate, and within a short period of time, about 500 robotic arms were employed in diecasting. This was the first RR where a robot was able to build a car without any human interactions. In 1969, Unimate robots took over one manufacturing plant in Lordstown, Ohio, they could “build 110 cars per hour - more than double the rate of any automotive plant in existence at the time” [8] Robot-based automation is the first wave of RR, and it has been around for more than 50 years.

#### **2.1.2. Sensitive and Safe Robot-Based Automation**

The second wave of RR has already been discovered as well. It all about the sensitivity and safety of robot-based automation solution. Both are very important in the field of robotics as sensitivity allowed robots to feel the external forces that allowed it to do a whole new area of tasks such as collections detection, applying exact measurement of forces to surfaces, etc. That said, with this new area of possibilities “lies in the intrinsic safety that can be realized with such

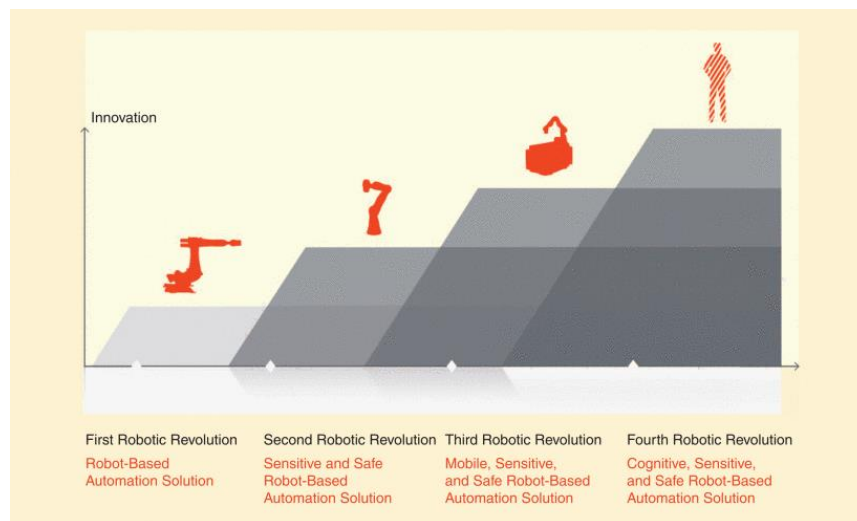
machines” [7]. At the present time, humans play a significant factor in the productions and “collaboration” of robots, but there will come a day where robots will be reaching and exceeding the level of human intelligence, and when that time comes robots will start creating other robots with zero human interactions.

#### 2.1.3. Mobile, Sensitive and Safe Robot-Based Automation

The first couple of RR waves changed how everyone thinks of robotics, it brought a whole new field to the industry and brought new concepts to life. This third concept will do the same when it happens. This concept will come true when the second wave of RR goes mobile. This will “fundamentally alter the concepts of manufacturing and automatization, because for the first time it will not be required that the workpiece comes to the robot, but the robot will get to the workpiece” [7]

#### 2.1.4. Perceptive and Cognitive, Mobile, Sensitive, Safe Robot-Based Automation

Each of the first three waves of RR shows improvement in the robots’ capabilities at every stage, and at each one we can see the shift in patterns of how they interact with the world. The forth steps is different as it is driven by how the robots are programmed. Going back to what I mentioned before, this will allow the robots to understand their surroundings, it will allow robots to know and understand what they are doing; this is where the future is headed. When is this going to become a reality? No one’s knows as we do not have the technology to achieve such a vision as of the present day.



*Figure 2: 4 Robotic Revolutions – Waves of Robotic Disruption [7]*

## 2.2. Computing Advancement

Computing advancement works hand-in-hand with the future of robotics. We can't develop faster, more complex robots if the computing technology stays the same every year. Fortunately, we live in the world of computing that is ran by Moore's [5] Law, the density of transistors on an integrated circuit doubles roughly every twelve months, and every computing company plan to achieve this law every year as they know their competitors are doing the same.

## 2.3. Generation 'R'

First time the term Generation 'R' was used was in the CIO summit 2013. And for This Generation 'R' (abbreviated for Generation Robotics) will be the first generation of Robotic Natives. The parallels to today's Digital Natives are self-evident: Today's society is characterized by the daily use of the internet, smartphones, computers, tablets and other communication devices and technologies [9]. It will be a generation that grows in a world augmented by robotics and smart machines. Like our generations is using smartphones and such small tablets in our everyday life, the generation 'R' will be born into a world augmented by automatization where they interact with robots, flying cars, self-driving cars in their daily life.

## 2.4. The Blue-Collar and White-Collar Workers

For this paper, I follow others in defining blue-collar workers as those who perform primarily physical work and whose career paths are relatively restricted (Gibson & Papa, 2000; Lederer, 1987) and white-collar workers as professional and semi-professional employees (Hammer & Ferrari, 2002) [4]. When it comes to technology, both types of collar workers are at risk of being jobless in the near future.

On the one hand, blue-collar workers are being replaced by industrial robots. One of the leading robotics companies KUKA is working on a new IR that has two arms. Most IRs as of now are separate arms as the ones that used in automobiles assembly lines.

On the other hand, as mentioned in the previous section, computed powers in doubling exponentially in growth every year, which shows that computers are becoming smarter and more powerful, which leads to the fact that at some point there will be no need for white-collar workers.

## 2.5. Driverless cars

We can see that so many companies nowadays are working on the next big thing: driverless cars, aka autonomous vehicles. Not only that, other companies are looking into flying cars. The Institute of Electrical and Electronics Engineers (IEEE) predicts that by the year 2040, highways will have designated lanes for autonomous vehicles (Read, 2013). This is enormous to think about it, it is a step closer to have the Generation ‘R’ become a reality. Even though the technology is still being tested, it holds some benefits, and some disadvantages for the future which will be more deliberated in the discussion section.

## 3. Discussion:

### 3.1. Future of Robotics

Robotic advancements are growing in a powerful way, and every company is trying to create the next big thing, from industrial robots, to driverless cars, and more. “According to a new report by Allied Market Research, the global industrial robotics market is expected to grow at a CAGR of 5.4% during the forecast period from 2013 to 2020, reaching a market size of \$41.17 billion in 2020. The market was valued at \$26.78 billion in 2012.” [11] This shows that no one is backing down, and everyone wants to invest in the new robotic technology. One of the robotic leading companies KUKA is currently producing double arms industrial robotics, one arm can build a car, imagine the new possibilities that can be achieved with two arm IRs, that will change the industry, and make everything at least twice as fast and defiantly more efficient

### 3.2. Computing Advancement

Going back to Moore’s Law, new technology and idea are coming out every day, once we see something that is the biggest most advanced we have seen so far, someone announces something way better the day after. We can see the double exponential growth of computing over the years in Fig. 3.

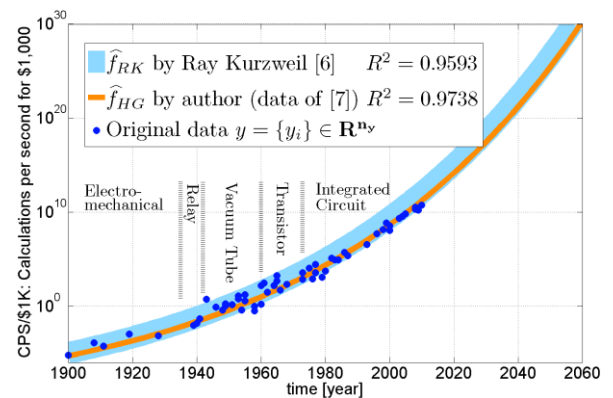


Figure 3: Double exponential growth of computing power  $f_{RK}$  in 20th through 21st century [18]

“The worldwide Internet of Things (IoT) market will increase 133% to \$3.04 trillion in 2020, according to a new IDC forecast. The number of IoT-connected units will reach approximately 30 billion in 2020.” [16] That is just an estimation, but given this data combined with Moore’s Law and the future technology that will be made by then, the possibilities will be endless.

### 3.3. Generation ‘R’

While it is still a new term and not widely used, Generation ‘R’ will be the generation where most likely our grandchildren grow up in and be the Generation ‘R’ of Robotics Natives. At that time, we will be called the ‘Robotic Immigrant’ which basically describes an older generation that is living in a world that is conquered by automation in which they didn’t grow up in; similar to our parents is the present day where they did not have the smartphone, and such technologies in their day; this makes us ‘Digital Natives’, and our parents ‘Digital Immigrants’.

“Robotics, automatization and artificial intelligence – especially in combination – have the potential to fundamentally disrupt our society, communal life and our way how to interact with other people” [17] So, we should be more responsible in creating a futuristic world that is safe for our grandchildren, a world that is combined of four waves of Robotic Revolutions as our grandchildren will be the ones that will be Natives of the ‘R’ generation.

### 3.4. Blue-collar and white-collar workers

As seen in Fig. 4, the jobs that require less experience such as bank teller, telemarketer, or jobs that are easier for recent college graduates to get are at higher risk of becoming computerized, while higher position such as C-level management, and surgeons as at a low risk of getting replaced by machines, at least in the near future.

“Faced with an acute and worsening shortage of blue-collar workers, China is rushing to develop and deploy a wide variety of robots for use in thousands of factories.” [12] People in the U.S. fear losing their jobs due to technology advances, but in China the government is scared of not having

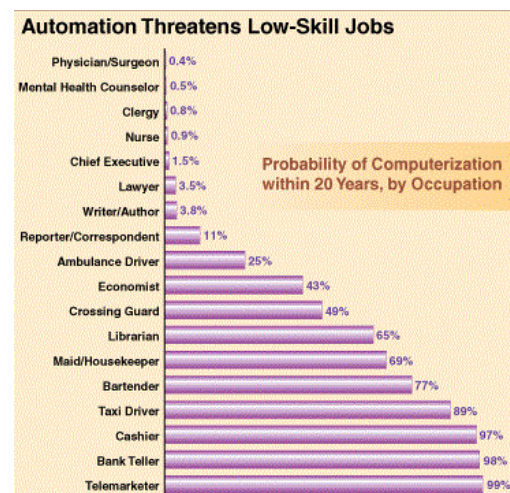


Figure 4: Future of automation by occupation [15]

enough people to get the work done. The Chinese government decided to contract KUKA with a project called “Replacing humans with robots” where the goal of the project is to reduce the workforce by 50% by replacing the human worker with robots, and many companies are working towards this goal, and they have successfully done so with one company, Midea, where they replaced half of the employees with robots.

“The Foxconn factory has reduced its employee strength from 110,000 to 50,000, thanks to the introduction of robots. It has tasted success in reduction of labor costs .... As many as 600 major companies in Kunshan have similar plans, according to a government survey.” [13] “Some of the first jobs to fall to white-collar automation are sure to be the entry-level positions taken by new college students” [14]

So big corporations, even though they care about their employees, they have to consider where the future is heading, and think about the big picture, if they do not follow companies like Foxconn, and Midea, they will get to a point where they will be way behind to a point where they might not be able to recover from.

### 3.5. Driverless cars

Driverless cars are the future. There are a good number of companies that are currently working on the production and testing of such vehicles, and in 2013 few states inserted state laws in the books regulating the testing of these vehicles on the street. The federal government uses a four-level classification system in defining autonomous vehicles, in this paper we only care about the 4<sup>th</sup> level of this classification as level 4 vehicles do not require the assistance of the human side, it will be completely autonomous and independent.

Having autonomous vehicles will have positive and negative outcomes. On the one hand, “The Eno Center for Transportation, a think tank in Washington, estimates that, at 90 percent market penetration, autonomous vehicle technology could save the country \$201 billion annually and a whopping \$447 billion in comprehensive benefits from savings related to reduced congestion and fewer crashes” [10] that is just one of the benefits of having driverless cars, another one “it was estimated that improved roadway safety afforded by autonomous vehicles could prevent 32,000 roadway fatalities annually” [19].



On the other hand, a successful deployment of driverless cars will cost millions of people their jobs, and leaves them with no income, such as the drivers of Taxi's, Trucks, Uber, Lyft and more.

#### **4. Recommendations, and Conclusions:**

Based on the research I have conducted, I have seen people give different estimations of the future expenditure of Industrial Robotics, one side said that global spending on industrial robotics has more than doubled from \$5.2B in 2005 to 11.6B in 2015, and is expected to reach 24B in 2025 [1], another side said, "the global industrial robotics market is expected to grow at a CAGR of 5.4% during the forecast period from 2013 to 2020, reaching a market size of \$41.17 billion in 2020. The market was valued at \$26.78 billion in 2012." [11], even though different researchers have given different estimations of the future of spending on IR, one thing that is clear and that is that the amount spent on IR is increasing in high amounts.

This means that blue-collar workers need to take this data seriously, the robots are coming, and they will take over their jobs as it will save the companies an enormous amount of money, and to the top management it's about the bottom line. So, since this major impact will take few years to start impacting the world, the younger generation needs to step up their game, and try to get more advanced experience, or head back to school to give themselves an edge over the robots.

I consider myself a Native Digital, and I see how the older generation are struggling with using the digital technology, or they are reluctant to change. But there will come a time where our grandchildren will be Natives of the Generation 'R', and when that time comes they will have the advantage over us, or over our children, as they will be raised in a world that is automatized. They will be raised in a world filled with new jobs and opportunities. But what that means to us?

Again, blue-collar and white-collar workers need to start thinking about the future, and what they can do to secure a job for themselves. It could be to move up the chain as quick as possible, or think about becoming an entrepreneur like a good number of people nowadays.

Finally, autonomous vehicles are the future of this world. Computing advancement accompanied with great minds that are working toward a world dominated by automation makes the idea of autonomous vehicles possible. But what will happen to the drivers? As mentioned before, recent college students are at big risk of not having a job due to robotic advancement. Just last month I was talking to a student who is graduating this semester, and asked him what he wants to do, and his response was that he wants to drive for Uber and Lyft

until he lands a job with his degree. A lot of people are driving for these companies either in their spare time, or as a full time job. “The development of self-driving cars or autonomous vehicles has progressed at an unanticipated pace. Ironically, the driver or the driver-vehicle interaction is a largely neglected factor in the development of enabling technologies for autonomous vehicles” [20]

With every advancement in technology, from the first industrial robot Unimate 1900, to driverless and flying cars, the people who make a living doing whatever these technologies are going to do are being neglected. That said, we cannot blame the entrepreneurs who create the technologies, we should embrace it, and think about what else we can do. If someone does not develop the next big thing because they do not want to leave people unemployed because of it, someone else will jump and create it. We live in a world where everything is possible, and even though a lot of people are expected to be let-go from whatever position they have due to advancement in technology, something else will come up, and live will go on.

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