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TECHNOLOGY TRENDS AND IMPACT OF ROBOTICS IN THE CORPORATE WORLD AT DIFFERENT LEVELS OF MANAGEMENT

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ABSTRACT

Roboticians develop man-made mechanical devices that can move by themselves, whose motion must be modelled, planned, sensed, actuated and controlled, and whose motion behaviour can be influenced by "programming". Robots are called "intelligent" if they succeed in moving in safe interaction with an unstructured environment, while autonomously achieving their specified tasks. Robots are very powerful elements of today's industry. They are capable of performing many different tasks and operations precisely and do not require common safety and comfort elements humans need. However, it takes much effort and many resources to make a robot function properly. Most companies that made robots in the mid-1980s no longer exist, and only companies that made industrial robots remain in the market. As with humans, robots can do certain things, but not other things. As long as they are designed properly for the intended purpose, they are very useful and will continue to be used. Robotics technology is developing at a rapid pace, opening up new possibilities for automating tasks and enriching the lives of humans. Robotics is a part of our world.

KEYWORDS

robotics, technology trends.

INDUSTRIAL ROBOTICS

Industrial robotics play a key role in automation and have helped improve manufacturing and assembly operations around the world. Using industrial robotics, machines and tools can be mounted onto robotic wrists, for example, that perform functions precisely and quickly. Industrial robotics offers numerous advantages over manual industrial labor or fixed automation including increased speed and the ability to function in harsh environments. Added flexibility and dexterity offered by industrial robotics help manufacturers get jobs done faster, while cutting costs. In the future, technological advancements are expected to further increase the intelligence of robots that will be able to learn, see and sense things - and complete even more tasks.

ROBOTICS TECHNOLOGY TRENDS

In the manufacturing field, robot development has focused on engineering robotic arms that perform manufacturing processes. In the space industry, robotics focuses on highly specialized, one-of-kind planetary rovers. Unlike a highly automated manufacturing plant, a planetary rover operating on the dark side of the moon - without radio communication - might run into unexpected situations. At a minimum, a planetary rover must have some source of sensory input, some way of interpreting that input, and a way of modifying its actions to respond to a changing world. Furthermore, the need to sense and adapt to a partially unknown environment requires intelligence (in other words, artificial intelligence).

From military technology and space exploration to the health industry and commerce, the advantages of using robots have been realized to the point that they are becoming a part of our collective experience and every day lives. They often function to relieve us from danger and tedium: Safety - Robotics have been developed to handle nuclear and radioactive chemicals for many different uses including nuclear weapons, power plants, environmental cleanup, and the processing of certain drugs.

Unpleasantness - Robots perform many tasks that are tedious and unpleasant, but necessary, such as welding or janitorial work.

Repetition and Precision - Assembly line work has been one of the mainstays of the robotics industry. Robots are used extensively in manufacturing and, more glamorously, in space exploration, where minimum maintenance requirements are emphasized.

LAWS OF ROBOTICS

Isaac Asimov, who is considered to be the Father of Robotics, proposed three "Laws of Robotics" in 1942, later adding the Zeroth Law:

- **Law 0:** A robot may not injure humanity or through inaction, allow humanity to come to harm
- **Law 1:** A robot may not injure a human being or through inaction, allow a human being to come to harm, unless this would violate a higher order law
- **Law 2:** A robot must obey orders given to it by human beings, except where such orders would conflict with a higher order law
- **Law 3:** A robot must protect its own existence as long as such protection does not

Brawn, Bone & Brain

There are 3 aspects of any robot:

- **Brawn** – strength relating to physical payload that a robot can move.
- **Bone** – the physical structure of a robot relative to the work it does; this determines the size and weight of the robot in relation to its physical payload.
- **Brain** – robotic intelligence; what it can think and do independently; how much manual interaction is required.

Because of the way robots have been pictured in science fiction, many people expect robots to be human-like in appearance. But in fact what a robot looks like is more related to the tasks or functions it performs. A lot of machines that look nothing like humans can clearly be classified as robots. And similarly, some human-looking robots are not much beyond mechanical mechanisms, or toys.

ROBOT INTELLIGENCE

Even with primitive intelligence, robots have demonstrated ability to generate good gains in factory productivity, efficiency and quality. Beyond that, some of the "smartest" robots are not in manufacturing; they are used as space explorers, remotely operated surgeons and even pets – like Sony's AIBO mechanical dog.

In some ways, some of these other applications show what might be possible on production floors if manufacturers realize that industrial robots don't have to be bolted to the floor, or constrained by the limitations of yesterday's machinery concepts.

With the rapidly increasing power of the microprocessor and artificial intelligence techniques, robots have dramatically increased their potential as flexible automation tools. The new surge of robotics is in applications demanding advanced intelligence. Robotic technology is converging with a wide variety of complementary technologies – machine vision, force sensing (touch), speech recognition and advanced mechanics. This results in exciting new levels of functionality for jobs that were never before considered practical for robots.

The introduction of robots with integrated vision and touch dramatically changes the speed and efficiency of new production and delivery systems. Robots have become so accurate that they can be applied where manual operations are no longer a viable option. Semiconductor manufacturing is one example, where a consistent high level of throughput and quality cannot be achieved with humans and simple mechanization. In addition, significant gains are achieved through enabling rapid product changeover and evolution that can't be matched with conventional hard tooling.

HIRE A ROBOT OR AN EMPLOYEE?

The idea of having a corporate function focused on managing labor resources is one that has been around for more than two centuries (corporate functions emerged following the advent of labor unions in the late 1700s). Since then the function has gone by several names, the most commonly applied being "human resources." Unfortunately the name "human resources" has gotten in the way of what the function was created to accomplish (bringing labor and management together in a manner that benefits both).

In the vast majority of organizations, be they large or small, when labor solutions need to be developed, the solutions provided by the human resource function are always "people solutions" (i.e. hiring, developing, rewarding, performance management, etc.) That narrow scope was fine when 95% of the work to be done in an organization was accomplished by an employee, but that simply isn't the case anymore. Today organizations leverage a vast array of labor types including automation, outsourced service providers, and contingent workers to get things done. Some studies now indicate that in larger organizations when outsourcing and contingent spend is added together, it exceeds what is spent on wages and benefits for regular employees.

If the HR function and those that lead it are to be truly strategic, they must acknowledge that today managers deal with a complex array of labor solutions and that maintaining a narrow scope of employee only solutions not only limits the applicability of the function, but also harms the business by fragmenting "labor procurement/management." A truly strategic HR function would follow the lead of marketing, supply chain, and manufacturing by offering "integrated solutions" that pair the best labor resource engaged in the optimal manner for the work that needs to get done at any point in time.

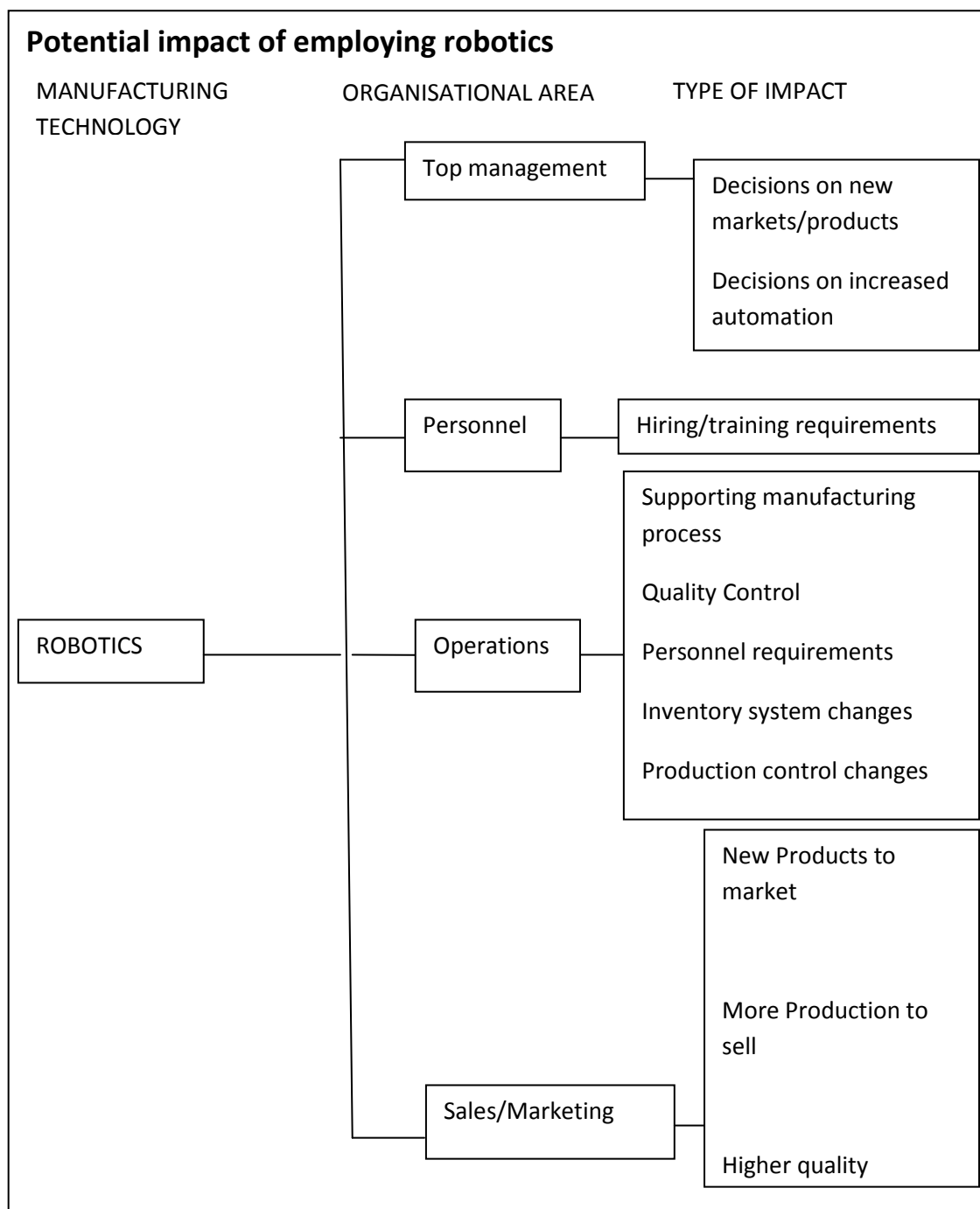
TECHNOLOGY HAS COME A LONG WAY

Machines have been replacing human labor for nearly a century but only recently have solutions become so accurate and reliable that they could automate a great deal of business decision-making and analysis. Google or Bing for example are at least a thousand times more effective than a traditional reference librarian in finding a quote or a fact. And, just in case you have not kept up on your reading of "Robot Daily," you should know that there are now 8.6 million robots in use around the world with application in military, police, aerospace, and medicine.

...robots will take over approximately 50% of the jobs in the U.S. economy over the course of just a decade or two –Marshall Brain

Technology has many advantages over people, including the ability to work 24/7, no demand for overtime pay, predictable maintenance (healthcare) cost, and no threat of unionization.





Source: J. Michael Alford, Ph.D., ROBERT E. KRIEGER PUBLISHING COMPANY, MALABAR, FLORIDA 1988

ROBOT- LABOR

The automobile industry has already seen the beginning of the robotic revolution. 2010 robots, only performing at an intelligence level of "insects" are capable of performing simple, repetitive tasks found on an assembly line. The military is using them to search and disarm bombs, and robots helped seal the gushing oil well in the Gulf of Mexico. Hospitals and Business are even experimenting with robo-docs and robo-employees. Army and BP robots require a human at one end controlling the machine. In effect, they are complex puppets with virtual strings ranging worldwide. robots of 2040, then these future machines will be able to perform far more complicated programs without human controllers.

Machines capable of creative human thought or human inspiration. These are not robots capable of inventing a new food recipe or designing a house. In 2040, I imagine there will still be a demand for creative chefs and architects.

Rather conservatively, his robots of 2040 are capable of running extremely complex multi-step programs. Imagine a robot that can cook and prepare a fast-food meal, or a robot that can assemble a building. Imagine robots that can lead a customer to the proper shelf at department and ring-up that sale.

DO ROBOTS TAKE PEOPLE'S JOBS?

The real purpose of automating manufacturing is to eliminate skilled workers and replace them with low paid button pushers—preferably offshore," "As jobs at all levels, from McDonald's to college-educated knowledge-workers, are increasingly automated, there will be more unemployment."

ARE ROBOTS TAKING OVER THE WORKPLACE?

It's been happening for decades; Robots performing jobs that were once done only by humans. It began with manufacturing; Mass production. Why pay for 10 humans to do something when one single machine can do it faster, better and cheaper? Machines aren't superior to humans, but they don't take breaks, days off or sick leave and they perform a task exactly the same way over and over. There's never any variation.

HUMAN Vs. ROBOT LABOUR

Humans, on the other hand, have to be paid week after week, year after year. They go on vacation and still have to be paid. They get sick and still have to be paid. They retire and never come back and still, they have to be paid. And this is for slower work, lower efficiency and a reduced likelihood that the task will be performed identically every time.

That was why robots were originally brought into the workplace. These days, however, there are myriad reasons that robots are doing jobs once performed by humans. Some jobs have become too large scale for humans. Using a robot to do the job allows it to be done on a scale that was previously impossible. The opposite is true as well. Robots are also used to do things that are too small or sensitive for humans to handle. One of the latest technological trends these days is nanotechnology, the creation and use of robots so tiny that they can't be seen by human eyes. Eventually they'll be able to repair nerves or unclog arteries from the inside without having to do surgery.

DO ROBOTS MAKE THE WORLD SAFER FOR PEOPLE?

Another reason why robots take human jobs is to reduce the danger to humans. There is still plenty of danger for workers on many jobs, but more and more these days the most dangerous tasks are being relegated to robots.

Today, robots have replaced many thousands of humans in the workplace, but the jobs being replaced are the low-end jobs; repetitive jobs that don't require any thinking. That may not always be the case. In the September 2008 issue of Popular Science Steven Dick, Chief Historian for NASA, says some scientists speculate that within just a few decades the most complex machines will become sentient, self-aware, thinking beings

THE NEXT WAVE – FUTURE ROBOTICS

- Robots in both physical and electronic forms will become integrated into our society.
- Robots can already express functional emotions and reasoning.
- Advanced robots-androids have begun appearing similar to human beings and fill roles in retail commerce, community, and government. For example, machine kiosks and unmanned vehicles
- Robotic efficiency and precision will transform manufacturing, medicine, space travel, research, and industry and displace skilled human workers.
- The robotics industry is rapidly becoming a multi-billion dollar global business, spawning many new careers and business opportunities.
- Human beings will adopt robotic human enhancements to achieve super-human capabilities both physical and mental processing using biotechnology
- Cyborgs-part human, part robot-will develop skills superior to natural humans to meet the demand of specialized jobs. Medical applications for disabled are also available now.
- We will encounter serious ethical, security, and social issues due to our robotic creations.
- Robots will provide convenience, safety, and productivity that will benefit humanity and profoundly impact lifestyles.
- Androids will achieve basic levels of self-awareness able to interact naturally

ROBOTS IN 2015

When the robots start arriving in massive numbers to take half the jobs effects will be profound. At this moment in history, we are standing right on the edge of the transformation to a robotic nation.

**REPLACING ALL THE PILOTS**

Robots in the workplace will be a very popular idea because they will eliminate labor costs. Pilots will be the first to go because pilots are incredibly expensive and their jobs are largely automated already.

Let's say that, in 2015, one airline decides to completely automate the cockpit and eliminate its pilots. Since pilots are expensive, that airline will have a real price advantage over its competitors. That airline will also have far more scheduling flexibility because it will not have to worry about crew availability.

ROBOTS IN RETAILERS

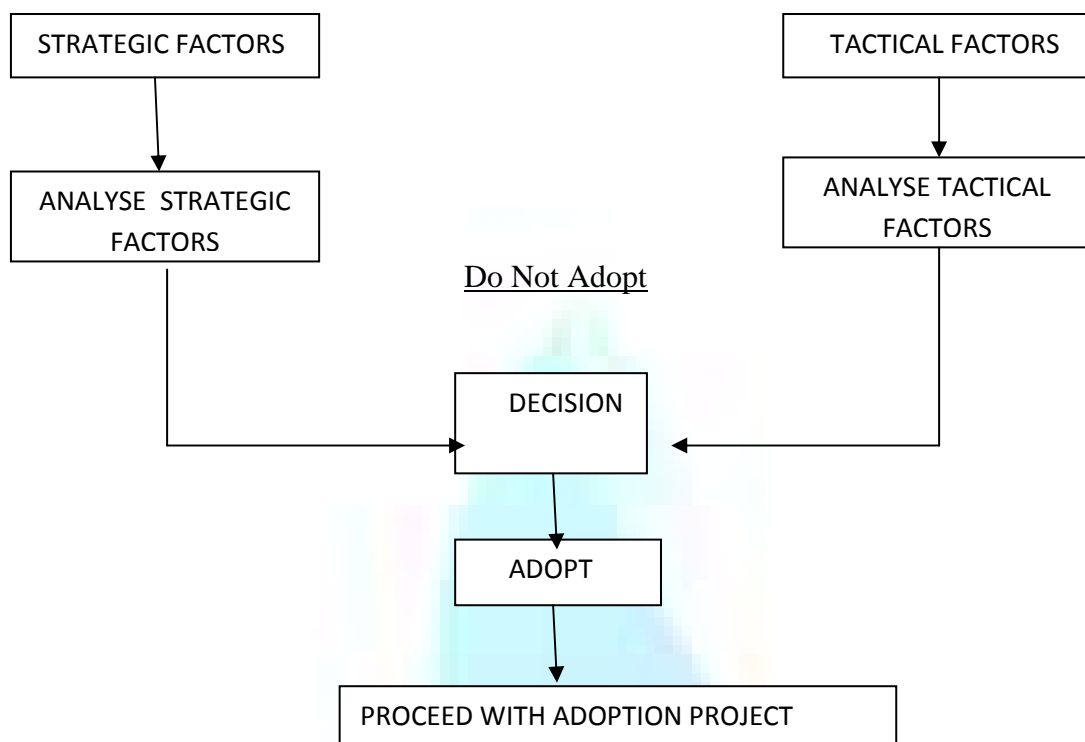
Wal-Mart or Target or some other large retailer will be introducing a totally automated inventory management system. Every shelf will be fitted with RFID tags and bar codes, allowing a mobile pick-and-place robot to find the exact shelf location of every product in the store. Every individual product in the warehouse will also be fitted with an RFID tag and bar code, so the robot will be able to pick up and identify every product that it needs to shelve. A relatively simple computer vision system will allow the robot to stack items on the shelves. These inventory management robots will operate 24-hours-a-day shuttling merchandise from the back of the store onto the shelves as items are sold. The robots will also constantly straighten the shelves and re-shelve merchandise. All of the technology needed to do this is nearly in place today.

By 2015, every big box retailer will be using automated checkout lines. Robotic help systems will guide shoppers in the stores. The automated inventory management robots will allow the first retailer to lay off a huge percentage of its employees.

CREATING NEW JOBS

Why won't all the new companies that are making these robots create millions of new jobs in 2015? Why won't these new jobs absorb all of the unemployed pilots and service-sector employees?

DECISION MODEL FOR ROBOTICS ADOPTION
NEW TECHNOLOGY ROBOTICS



STRATEGIC FACTORS
 Capital investments
 Competitive position
 New Markets/Products
 Industry structure
 Product/Market Growth Stage
 Economic Analysis
 Organizational Structure
 Demographics

TACTICAL FACTORS
 Productivity increase
 Quality, Scrap, Rework
 Technological change
 React to Product Changes
 React to Market Demands
 Inventory
 Production Process Impact
 Economic Analysis Cost
 Work Force Training

Source: J. Michael Alford, Ph.D., ROBERT E. KRIEGER PUBLISHING COMPANY, MALABAR, FLORIDA 1988

ETHICAL AND SOCIAL IMPLICATIONS

The application of rapidly advancing fields of software and hardware engineering and biotechnology to recreate life or intelligence raises ethical and social issues. There is an ethical responsibility on the part of the creator to ensure that the robot or virtual pet causes no harm. There is also the impact of new technology on society. On the one hand, replacing people with robots may reduce labour costs and contribute to unemployment in society, but new jobs in the information technology industry are created.

ETHICAL IMPLICATIONS

Robots appeared in fiction as early as 1917, and by the 1920s writers were already depicting the robot as a mechanical worker or servant that could be either an aid or a menace to humanity. The word robot was first used in the 1921 play *R.U.R.* (Rossum's Universal Robots), by Czech writer, Karel Capek.

Remember that in Mary Shelley's novel *Dr Frankenstein* was so terrified of his creation that he ran away, leaving the 'monster' to fend for himself, with nobody to care for him and teach him. The creation carried out a terrible plan of revenge on its maker. The message in this is a question of ethics. If we start making creatures that are alive and intelligent, then we have to start thinking about how we will treat them, or suffer the consequences.

SOCIAL IMPLICATIONS

Since the introduction of automation in industry (the first major automation was achieved on weaving looms, and its opponents were called luddites) there has been an understandable fear of the introduction of technology. Automated looms were designed to do the same job as the weavers. Thousands of workers lost their jobs when these machines were introduced. More recently the introduction (from 1980) of automated tellers has displaced thousands of jobs in the banking industry.

Labour-intensive heavy industries were quick to adopt robotic technologies in the interests of perceived efficiencies, safety and economy. Robots can work round the clock, are easier to repair, don't get sick and don't require staff amenities. Replacing people with robots was seen as a way of reducing labour costs, workers' compensation and union influence. The replacement of people by automated systems contributes to unemployment in society, especially for the most disadvantaged group — unskilled workers — which can result in long-term unemployment.

Robots have also created new jobs directly and can create wealth, leading to the development of new industries and jobs.

STRATEGICAL IMPLICATIONS OF EMPLOYING ROBOTS

The strategic implications of the employment of robotics are those related factors which have the potential for affecting the long-term operations and providing a competitive advantage to the firm.

AUTOMATION AND EMPLOYMENT

Robotics is an essential component in any modern manufacturing environment. As factories increase their use of robots, the number of robotics related jobs grow and have been observed to be on a steady rise.

EFFECTS ON UNEMPLOYMENT

Robots and other forms of automation will ultimately result in significant unemployment as machines begin to match and exceed the capability of workers to perform most jobs. At present the negative impact is only on menial and repetitive jobs, and there is actually a positive impact on the number of jobs for highly skilled technicians, engineers, and specialists. However, these highly skilled jobs are not sufficient in number to offset the greater decrease in employment among the general population, causing structural unemployment in which overall (net) unemployment rises.

As robotics and artificial intelligence develop further, some worry even many skilled jobs may be threatened. In conventional economic theory this should merely cause an increase in the productivity of the involved industries, resulting in higher demand for other goods, and hence higher labour demand in these sectors, off-setting whatever negatives are caused. Massive unemployment causes a sharp downward spiral that hurts the entire economy and the entire nation.

ARE ROBOTS A BOON OR A BURDEN TO THE ECONOMY?

Automation is going to do more than just play a game of musical chairs with the available jobs in the world. In the short term, robotics and artificial intelligence may create a battle between out-sourcing and automation. Eventually, however, every side is going to use robots. Everyone is going to be developing AIs that replace human labor. With the increasing inter connectivity of the global economy it's going to become less important whether jobs are being sent to India or the US, and much more important about how the shift in employment affects the average (global) citizen.

ROBOTS AND THE ENVIRONMENT

Robots eliminate pollution, save lives and gauge environmental damage. Robots are valuable environmental tools.

- They have investigated and cleaned up after nuclear power plant disasters, saving countless people from exposure to deadly radiation.
- Some robots are built to withstand intense temperatures, navigate through smoke with ease, and lift heavy items.
- Robots clean asbestos from pipes, and safely strip paint from ships.
- They have helped biologists tackle pollution and safeguard the environment.



CONCLUSION

Robots offer specific benefits to workers, industries and countries. If introduced correctly, industrial robots can improve the quality of life by freeing workers from dirty, boring, dangerous and heavy labor. It is true that robots can cause unemployment by replacing human workers but robots also create jobs: robot technicians, salesmen, engineers, programmers and supervisors.

The benefits of robots to industry include improved management control and productivity and consistently high quality products. Industrial robots can work tirelessly night and day on an assembly line without an loss in performance.

Consequently, they can greatly reduce the costs of manufactured goods. As a result of these industrial benefits, countries that effectively use robots in their industries will have an economic advantage on world market.

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Thanking you profoundly

Academically yours

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