Safety and Health at Work 5 (2014) 198–202

Contents lists available at ScienceDirect

Safety and Health at Work

journal homepage: www.e-shaw.org

Original Article

The Impact of Robotics on Employment and Motivation of Employees in the Service Sector, with Special Reference to Health Care

Mohammed Owais Qureshi [1], Rumaiya Sajjad Syed [2,*]

[1] Department of Human Resource Management, College of Business, King AbdulAziz University, Rabigh, Saudi Arabia
[2] Department of Health and Hospital Management, College of Business, King AbdulAziz University, Rabigh, Saudi Arabia

ARTICLE INFO

Article history:
Received 14 February 2014
Accepted 14 July 2014
Available online 29 July 2014

Keywords:
employment
health care sector
motivation
robotics

ABSTRACT

Background: The economy is being lifted by the new concept of robotics, but we cannot be sure of all the possible benefits. At this early stage, it therefore becomes important to find out the possible benefits/limitations associated with robotics, so that the positives can be capitalized, established, and developed further for the employment and motivation of employees in the health care sector, for overall economic development. The negatives should also be further studied and mitigated.
Methods: This study is an exploratory research, based on secondary data, such as books on topics related to robotics, websites, public websites of concerned departments for data and statistics, journals, newspapers and magazines, websites of health care providers, and different printed materials (brochures, etc).
Results: The impact of robotics has both positive and negative impacts on the employment and motivation of employees in the retail sector. So far, there has been no substantial research done into robotics, especially in the health care sector.
Conclusion: Replacing employees with robots is an inevitable choice for organizations in the service sector, more so in the health care sector because of the challenging and sometimes unhealthy working environments, but, at the same time, the researchers propose that it should be done in a manner that helps in improving the employment and motivation of employees in this sector.

1. Introduction

In this era of information explosion, human capital has become one of the main driving forces behind the economic success of service sector organizations. This is especially true in the health care sector, which, according to Centers for Medicare and Medicaid Services [24], consumes over 10% of gross domestic product (GDP) of most developed nations. As a share of the economy, health care has risen from 7.2% of GDP in 1965 to over 16% of GDP today, and it is projected to be 20% of GDP just 10 years. Thus, it has become even more important that human resources' in the health care should be managed well and, to do so, an integration of innovative technology with the day-to-day activities of employees should be the prime focus of organizations operating in health care.

In the past couple of decades the advancement in the technology of robotics has been enormous but at the same time there has not been much research conducted on the effects of the robotics on the employment and motivation of employees in the service sector, or in health care in particular. This research focuses on the impact of robotics on the employment and motivation of employees in the service sector with special reference to health care.

1.1. Statement of the problem

Organizations today are faced with increasing labor costs and a shortage of workers, and are thus investing in robotics. Robots never demand raises and are able to work around the clock. Robots can perform tasks that most humans could not possibly do, such as working in challenging conditions and being able to purport

* Corresponding author. Department of Health and Hospital Management (Female Section), King AbdulAziz University, Rabigh 21911, Saudi Arabia.
E-mail address: tehzeeb001@gmail.com (R.S. Syed).

2093-7911/$ – see front matter © 2014, Occupational Safety and Health Research Institute. Published by Elsevier. All rights reserved.
http://dx.doi.org/10.1016/j.shaw.2014.07.003

amazing feats with utmost precision. What makes a firm ready for the challenges of the future is not just technology but the management of human resources, especially the impact of robots on the employment and motivation of employees in the health care sector.

1.2. Objective of the study

The main objective of the research is to shed light on the facilitation of robotics in health care and its impact on the employment and motivation of employees, and also to assess its possible advantages/disadvantages. This is with the intention to raise awareness about positive and negative effects of robotics on the employees of the health care sector, and finally developing strategies for its use in small, medium, and large health care service providers. This research also provides a basis to study the various factors that should be responsible for attracting the health care providers to use robotics in their operations.

To achieve the main objective, the following subobjectives were set: (1) assess the impact of robotics on employment and employee motivation; (2) assess the impact of robotics on health care; and (3) assess the impact of robotics on employment and employee motivation in health care.

1.3. Research methodology

The research is based on secondary data taken from different books on the related topics, web portals, public websites of concerned departments for data and other statistics, various journals, newspapers and magazines, websites of selected health care providers, as well as different printed materials (brochures, etc.) collected from them. Substantial information has been gathered from these sources thus allowing for appropriate analysis, compilation, interpretation, and structuring of the entire study. Thus, in an attempt to isolate and categorize potential sources of robotics and its impact on the employment and motivation of employees in the health care sector, the available literature is reviewed.

2. Materials and methods

2.1. Literature review

A robot is a system that contains sensors, control systems, manipulators power supplies, and software all working together to perform a task [1].

Motivation is an employee's intrinsic enthusiasm about and drive to accomplish activities related to work. Motivation is that internal drive that causes an individual to decide to take action [2].

The service sector consists of the "soft" parts of the economy, i.e., activities where people offer their knowledge and time to improve productivity, performance, potential, and sustainability. The basic characteristic of this sector is the production of services instead of end products. Services (also known as "intangible goods") include attention, advice, access, experience, and discussion [3].

Health care is the diagnosis, treatment, and prevention of disease, illness, injury, and other physical and mental impairments in humans. Health care can form a significant part of a country's economy. In 2008, the health care industry consumed an average of 9.0% of the GDP across the most developed OECD countries. The USA (16.0%), France (11.2%), and Switzerland (10.7%) were the top three spenders [4].

2.2. Impact of robotics on employment and employee motivation

Companies such as iPhone manufacturer Foxconn (New Taipei City, Taiwan), which has been plagued by a series of labor scandals, has announced plans to add more than one million robots to its workforce. It still has a long way to go, however, as only about 20,000 are currently in use [5].

According to the International Federation of Robotics, overall paid employment has risen in most countries including Brazil, China, Republic of Korea, Germany, and USA, but not Japan, which has seen a decline. The statistics mainly show a reduction in employment in manufacturing in the developed countries, often a small reduction. This coincides with an increase in output and an increase in robotics use, except in the case of Japan. The robot industry itself generates 170,000–190,000 jobs worldwide, to which can be added the support staff and operators, another similar number of people. Despite the rapid increase in the use of robots, USA has proportionately half the number of robots used by Germany. Germany itself (partly because of a different industry mix) is third, behind Japan and Korea. The concept of "jobless recovery", where an industry comes out of a recession leaner, needing fewer employees, is only short term. It is likely to lead to more job creation by the leaner, more competitive companies. At the same time, the service sector continues to absorb most of the displaced people. Some of these new service people owe their jobs to a new robot driven industry. The research by the International Federation of Robotics further points out that, although automation displaces people in manufacturing, it almost always increases output.

In some cases this allows such an increase in production and related decrease in unit price, that creates a whole new market and generates the need for downstream jobs to get the product to the consumer. This releases employees for other, often new jobs outside manufacturing. An alternative view is that this displacement in the future will be more difficult to place, as service robotics may take over some or many of the new job opportunities in human tasks such as in banking, fast food chains, and retailing petrol forecourts [6].

David Sims in his blog reports that Drew Greenblatt, the president of Marlin Steel (MD, United States), an American company that manufactures wire baskets and sheet metal products praises the way robots have helped his company grow 25% and increase operational safety [7]. Greenblatt told Inc.com that when he bought the company, which was the largest bagel basket maker in the country, in the late 1990s, "the most modern technology in the plant was a fax machine," and the top workers could produce a basket by hand every 12 seconds. Today, robots can make five baskets per second, with precision that is "light years beyond what we were capable of before." Greenblatt argues that robots have made his workers more valuable and highly paid than their competitors. "Recently, we won a huge order for sheet metal brackets," he noted. "The brackets were formerly made in China by workers who earned $2.50 an hour and produced perhaps 50 an hour. Our sheet metal operator earns 10 times that rate, but sets up a robot that produces 2,000 brackets an hour." [8].

However, critics of the automation boom claim that such technological advancements are killing off middle-class jobs. Robots and automated systems have not only eliminated elevator operators and highway toll collectors, but are also making inroads into higher-skilled job functions, and the long-term effect in job losses among human workers may be much more severe than most expect [7].

2.3. Impact of robotics in health care

The Robotics for Healthcare study was funded by the European Commission, DG Information Society and Media, with the aim to investigate and develop a roadmap for the application of robotics in medicine and health care [9].

According to Kinetic consulting, by 2050 one in four people in the United Kingdom will be over the age of 65 years. Japan's population is the most rapidly ageing in the world—30 million people,

accounting for 25% of the population, are over the age of 65 years. To meet this challenge, health and local authority services must reconfigure, placing greater emphasis on community care and the effective use of technology. One promising technology is robotics [10].

Compared with humans, robots may be quicker to train, cheaper to maintain, easier to refuel and repair, and less prone to be bored by repetitive tasks. They could help the elderly and chronically ill to remain independent, reducing the need for carers and the demand for care homes [10].

According to a renowned blogging site, called information week, since 2000, the da Vinci Surgical System, has conducted more than 20,000 surgeries and has paved the way for robotic advancements in health care. In fact, vendors have introduced a number of new robots to better provide care to remote patients, help with various physical therapies and—similar to the da Vinci system—help perform surgery. For example, Magnetic Microbots are a group of tiny robots used in various operations, such as removing plaque from a patient's arteries or helping with ocular conditions and disease screenings. Other robotic advancements are used to better the day-to-day lives of patients, helping them eat, such as the Bestic Arm, or helping a patient regain her ability to walk, like many of Toyota's Healthcare Assistants [11].

In the next few years, thousands of "service robots" are expected to enter the health care sector—picture R2-D2 from Star Wars carrying a tray of medications or a load of laundry down hospital corridors. Fewer than 1,000 of these blue-collar robots currently roam about hospitals, but those numbers are expected to grow quickly [12].

Robots such as the Aethon TUG, according to the company, working just two shifts 7 days per week, saves the labor of 2.8 full-time equivalent (FTE) employees, yet costs less than a single FTE. Aethon TUG safely navigates through hospital corridors, elevators, and departments to get items from point A to point B. It rolls 24 hours, 7 days a week to make both scheduled and on-demand deliveries, and never gets sidetracked from its mission [13]. Swisslog's RoboCourier, a similar delivery system, increases staff efficiency with a run-time of 11 hours/day [14].

Giraff is a mobile communication solution that facilitates the elderly's contact with the outside world. It is remote-controlled, on wheels, and has a camera and monitor [15].

Another robot, called RP-VITA, is a result of a joint development effort between iRobot and Intouch Health. The system features mapping and obstacle detection, as well as avoidance technology and an iPad user interface for control and interaction. The robot can also interface with diagnostic devices and electronic medical records systems. The remote rig will eventually be able to navigate to specified target destinations autonomously [16].

Bestic is a unique innovation for those who want to eat by themselves without requiring help from others. Bestic is a robotic-assisted dining appliance for people who are unable to move their arms or hands. It is designed to be an integral part of a meal by being easily accessible and convenient in a manner that does not intrude on a dignified and pleasant eating experience [17].

A robot called Cosmobot is used by doctors to enhance the therapy of developmentally disabled children aged 5–12 years. Using the robot can make therapy more interesting for children and allows for better success when achieving long-term therapy goals [18].

A robot called AnyBots provides a type of immersive telepresence, meaning instead of focusing merely on audio and video communications, the AnyBots robot allows for movement controlled by a remote [19].

Toyota unveiled four robots designed to accomplish ambitious objectives at a Tokyo event. The robots help the paralyzed patients walk or balance and help their caretakers gently transport them. The company hopes to commercialize the products sometime after 2013 [9].

There is a well-documented shortage of nurses and direct-care workers in the United States and around the world, which is expected to become more problematic as the older adult population grows and prepares for retirement. In a study of the effects of high patient-to-nurse ratio, Aiken et al [25] showed that each additional patient per nurse was associated with a 7% increase in patient mortality and a 23% increase in nurse burnout. Consequently, studies have suggested that lowering the patient-to-nurse ratio would result in less missed patient care [20]. Thus robotics can play a role in assisting nurses to complete their daily tasks in order to provide better health care.

Robotic systems in nursing care to support the arduous work of the individual professional and to counteract the imminent staff shortages [9]. The pharmaceutical industry is continuously improving quality and increasing quantity of their products. Health care systems are being set up in more and more countries. The worldwide demand for pharmaceutical products is on the rise. The pharmaceutical industry was hardly affected by the economic crisis. Thus, investments in robots only slightly decreased in 2009. Similar trends can also be observed in the medical devices industry. In both industries, robot installations will gain momentum in the coming years [6].

2.4. Impact of robotics on employment and employee motivation in health care

Mid-level hospital jobs that don not require a bachelor's degree are quickly disappearing. The *Wall Street Journal* reports that positions such as licensed practical nurses and medical-records clerks are being eliminated or pushed out of hospitals into lower-paying corners of the field such as nursing homes. Meanwhile, positions that were once an accessible first rung on the career ladder, such as registered nursing, increasingly require at least a bachelor's degree [21].

Most of the experts interviewed by the *Wall Street Journal* were worried about all these job-stealing robots. Health care, after all, has become one of the last remaining fields in which one could earn one's way to a middle-class lifestyle without a college degree. In a time of growing economic inequality, the elimination of these jobs seems discouraging. Although the costs are real, there are also plenty of upsides. The most obvious are the efficiency gains that come with automation. Robots can do some jobs better, cheaper, and faster than humans. They can transcribe and store information, help doctors and nurses diagnose their patients, and even allow lower-skilled health care workers to treat patients with less oversight from doctors and other higher-skilled workers [22].

SingularityHub, a leading technology blog, reports that El Camino Hospital in Silicon Valley is looking to cut expenses, so they've invested in 19 Aethon TUG robots. These smart carts can haul supplies around the hospital, making deliveries and pickups at a fraction of the costs of human workers. El Camino Hospital, CA, United States recently announced that it would further be cutting costs by firing up to 140 workers from its two facilities in Los Gatos and Mountain View. According to a hospital administrator quoted in the Businessweek article the 19 TUGs perform $1 million of human labor/year, but only cost $350,000. A 65% reduction in labor costs [23].

3. Results

So far there has been no substantial research done to assess the impact of robotics on the employment and motivation of employees in service sector, especially in the health care sector.

In the near future efficiency gains through the use of automation will become more obvious and, thus, the installation of robots will

gain momentum and will play an important role in assisting health care professionals to complete their daily tasks and thus help in providing better health care.

Although robots can do some jobs better, cheaper, and faster than humans in the service sector and are in huge demand at various levels, which is always expected to increase in future, care should be taken regarding the employment and motivation of employees, as human resources form the basis of competitive advantage for any organization. Thus, there should be viable focus on training and development of employees, so as to meet the future challenges posed by the introduction of robotics. The researchers point out that the organizations in the service sector especially in the health care can improve the performance of the employees by emphasizing on excellent human resource practices such as employment and motivation.

It is worth mentioning here that the study found the impact of robotics had both, positive and negative impact on the employment and motivation level of the employees.

Furthermore, the research work is useful for the health care sector, to map the most important areas of concern with regard to the impact of robotics on employment and motivation of employees in health care. The focus can subsequently be on further development of effective, efficient, and employment friendly robots for the sector.

The researchers confidently conclude that this study has practical and policy implications for the companies in the service sector, especially in the health care sector.

4. Discussion

4.1. For health care sector

The health care sector is growing significantly and is showing a futuristic approach by introducing robots in the day-to-day operations but at the same time the research indicates that the sector is fast taking away jobs from the health care professionals and passing it on to the robots. The sector should invest in training and development of their human resources, so as to keep their skills and knowledge up to date, which in turn would motivate the health care professionals to work in tandem with robots. This approach is important, as history teaches us that people are the most precious components for change, at any level of development especially so in the current era of information explosion.

4.2. For the government

Government institutions should start collaborating with the service sector so that industry specific and futuristic courses are introduced for employees. Employment related initiatives for the human resources, who shall have to compete not only amongst themselves but with robots in the near future.

People make and spend money and help an economy to thrive. The case where more impetus is given to introducing robots into the system and less attention is paid to the future skill requirements of human resources, could lead to unemployment which would in turn lead to a vicious downward economic cycle.

4.3. Limitations of the study

The study is based on data collected from secondary sources only and there is scope for research based on primary data. Further, the questions included did not establish a link between unemployment and the introduction of robotics. Future researchers can take up further studies based on the above-mentioned limitations.

Conflicts of interest

All authors declare to have no financial or personal relationships that could inappropriately influence the research described.

Acknowledgment

We would like to extend our thanks to overall administration and policy of King Abdulaziz University in general in encouraging and promoting the research activities. Also, we would like to extend our gratefulness to the Deanship of Scientific Research for their continuous support and guidance in conducting this study and making it a reality.

References

[1] Introduction to Robots, Robotics [Internet]. 2003 [cited 2013 Jan 17]. Available from: http://www.galileo.org/robotics/intro.html.
[2] Heathfield SM. What is employee motivation? [Internet]. 2013 [cited 2013 Feb 5]. Available from: http://humanresources.about.com/od/glossarye/g/employee-motivation.htm.
[3] Tertiary sector of the economy [Internet]. 2013 [cited 2013 Feb 23]. Available from: http://en.wikipedia.org/wiki/Service_industries.
[4] Health Care [Internet]. 2013 [cited 2013 Jan 20]. Available from: http://en.wikipedia.org/wiki/Healthcare.
[5] Purnell N. A Chinese province is trying to solve its labor problems with robots [Internet]. 2013 [cited 2013 Nov 21]. Available from: http://qz.com/147887/a-chinese-province-is-trying-to-solve-its-labor-problems-with-robots.
[6] Positive impact of industrial robots on employment [Internet]. International Federation of Robotics. 2013 [cited 2013 Jan 16]. Available from: http://searchext.abb.com/library/Download.aspx?DocumentID=9AKK105713A4276&LanguageCode=en&DocumentPartId=&Action=Launch.
[7] Sims D. Are robots killing jobs or creating them? [Internet]. 2013 [cited 2013 Apr 9]. Available from: http://news.thomasnet.com/IMT/2013/02/05/are-robots-killing-jobs-or-creating-them.
[8] Greenblatt D. 6 ways robots create jobs [Internet]. 2013 [cited 2013 Apr 9]. Available from: http://www.inc.com/drew-greenblatt/6-ways-robots-create-jobs.html.
[9] Personalising care and boosting the quality, access and efficiency of healthcare [Internet]. Robotics for Health Care, Intuitive Surgical, Inc; 2013 [cited 2013 May 9]. Available from: http://www.studymode.com/essays/Robotics-In-Healthcare-Personalizing-Care-And-46056144.html.
[10] Robots in Health Care [Internet]. Kinetic consulting; 2013 [cited 2013 Mar 9]. Available from: http://www.kineticconsulting.co.uk/robots.html.
[11] 10 Medical robots that could change healthcare [Internet] 2012 [cited 2013 Mar 8]. Available from: http://www.informationweek.com/healthcare/mobile-wireless/10-medical-robots-that-could-change-heal/240143983.
[12] Hay T. The robots are coming to hospitals [Internet]. New York: The Wall Street Journal; 2012 [cited 2013 Mar 14]. Available from: http://online.wsj.com/article/SB10001424052702304459804577281350525870934.html.
[13] Sound ROI [Internet]. 2013 [cited 2013 Jan 17]. Available from: http://www.aethon.com/tug/benefits/.
[14] RoboCourier Quick Facts. Swisslog [Internet]. 2012 [cited 2013 Feb 18]. Available from: http://www.medlabmag.com/article/1094/Fall_2012/RoboCourier_from_Swisslog/.
[15] Giraff, robot dalen [Internet]. 2012 [cited 2013 Jan 17]. Available from: http://www.informationweek.com/mobile/10-medical-robots-that-could-change-healthcare/d/d-id/1107696?page_number=2.
[16] RP-VITA, irobot [Internet]. 2013 [cited 2013 Apr 19]. Available from: http://www.irobot.com/en/us/learn/commercial/rpvita.aspx.
[17] Bestic [Internet]. 2013 [cited 2013 Jan 23]. Available from: http://www.bestic.se/en/home/ [accessed 03.15.13].
[18] McNickle M, Robotic therapy, 10 medical robots that could change healthcare [Internet]. Information Week Healthcare; 2012 [cited 2013 Jun 5]. Available from: http://www.informationweek.com/mobile/10-medical-robots-that-could-change-healthcare/d/d-id/1107696?page_number=5.
[19] Anybots. 10 Medical robots that could change healthcare [Internet]. Information Week Healthcare; 2012 [cited 2013 Jan 10]. Available from:, http://www.informationweek.com/healthcare/mobile-wireless/10-medical-robots-that-could-change-heal/240143983?pgno=9#slideshowPageTop.
[20] Robotic nurse assistant [Internet]. Healthcare robotics; 2013 [cited 2013 Feb 10]. Available from: http://www.hsi.gatech.edu/hrl/project_nurse.shtml.
[21] Midlevel health jobs shrink [Internet]. New York (NY): The Wall Street Journal; 2013 [cited 2013 Apr 19]. Available from: http://online.wsj.com/article/SB10001424127887324345804578424560856966992.html?mod=WSJ_WSJ_US_News_5.
[22] Mead WR. Robots to health care workers: give us your jobs, please [Internet]. The American Interest; 2013 [cited 2013 Apr 29]. Available from: http://blogs.the-american-interest.com/wrm/2013/04/26/robots-to-health-care-workers-give-us-your-jobs-please/.

[23] Saenz A. Hospital to layoff workers, hires robots instead [Internet]. 2010 [cited 2013 Apr 19]. Available from: http://singularityhub.com/2010/09/02/hospital-to-lay-off-workers-hiring-new-robots/.
[24] Health Costs, Office of inspector General, U.S. Department of Health & Human Services, Archives - Centers for Medicare and Medicaid Services [Internet]. 2006 [Cited 2013 April]. Available from: https://oig.hhs.gov/reports-and-publications/archives/oas/cms_archive.asp#2006.
[25] Robotic Nurse Assistant. Healthcare robotics; 2013 [cited 2013 Oct 2]. Available from: http://www.hsi.gatech.edu/hrl/project_nurse.shtml.