Chapter 3

Perception of robots in Kenya's infosphere: Tools or colleagues?

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Abstract

For many years, robots have worked autonomously in highly controlled environments away from human beings. With increasing advancements in robotics, there is a notable effort to transfer robots from isolation to workspaces shared with human beings. This has the potential to revolutionise the concept of work in the information sphere as we know it today. As engineers and programmers take care of technological and software issues, one overarching concern relates to how robots and human beings will relate to each other in the shared workspaces in the infosphere. This chapter explores attitudes and perceptions of information workers in Kenya towards robots in the information workspace. Two major questions are addressed in the chapter: Are robots considered as machines or

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colleagues by information professionals in Kenya? Are they pieces of equipment, or would they function as co-workers? This chapter is anchored on primary data obtained through key informant interviews with 20 information professionals in Kenya and secondary data from the literature review. The findings indicate that whereas information professionals in Kenya acknowledge the potential role of robots in handling the dirty, dangerous and dull elements of work in the infosphere, they consider them as machines incapable of relating to human workers as colleagues. Given that there are currently no collaborative robots in Kenya's infosphere, the views of the professionals interviewed are not based on practical or actual perceptions. Nonetheless, these views are strengthened through literature from situations where collaborative robots exist. This chapter prepares information professionals to accept and collaboratively work with robots.

Introduction

Robots are programmable and self-controlled machines that perform specific tasks. Historically, robots have worked largely in industrial settings, performing repetitive tasks that were considered unsafe or unbearable for human beings (Puigbò, Moulin-Frier & Verschure 2016). The idea of developing the first industrial robot was proposed by John Devol, an American scientist, in 1954. It was not until 1961 when Devol, teaming up with an engineer called Joseph Engelberger, advanced the idea and built the first robot called *Unimate* (Gasparetto & Scalera 2019). *Unimate*'s first installation was done at the General Motors factory in Trenton, United States, where it was used to extract parts from a die-casting machine. Since then, robots have grown in number, variety and sophistication. According to estimates by the International Federation of Robotics (IFR), about 3 053 000 robotic units are expected to be operational globally by 2020. Of these, about 1.9 million are expected to be in Asia and 611 700 units in Europe. About 74% of the world's robots are expected to be installed in five countries, namely, China, Japan, the United States, South Korea and Germany (IFR 2020). According to Chutel (2017), Africa is lagging behind the rest of the world in shipments of industrial robots. It is estimated that shipment to the continent accounted for only 1976 out of the 1153 160 units shipped worldwide between 2014 and 2019. Although the current number of robots in Africa is low, it is increasing and will inevitably grow in the future.

Historically, robots worked with speed and precision in controlled industrial environments away from human beings (Hayes & Scassellati 2013). Sarkar, Araiza-Illan and Eder (2017) explained that industrial robots worked in

isolation to ensure the safety of people in those spaces. The emerging trend, however, is to transfer robots from isolation to workspaces shared with human beings. Consequently, robots are lately finding their way into normal working spaces (Nikolaidis & Shah 2012; Sarkar et al. 2017; Sherwani, Asad & Ibrahim 2020). This category of robots that work in close proximity with human beings is generally described as collaborative robots. They work alongside human beings and share their workspaces. These robots are in constant and close physical contact with human beings on a day-to-day basis. It is estimated that about 4 million workers worldwide are already collaborating with robots as co-workers, and the number is bound to increase as more robots find their way into the human workspaces (Moniz 2013). Steil and Maier (2017) estimated that the number of robots used in the human workspaces would grow by 400 000 robots a year. Europe currently hosts 47% of collaborative robots globally (Sherwani et al. 2020). Kaplan (2015) argued that robots would soon have a dominant presence in the world of knowledge work, doing white-collar jobs. Robots are being increasingly moved away from performing mechanical tasks and are executing more cognitive assignments. Sherwani et al. (2020) opined that the number of collaborative robots has increased to meet the needs of the Fourth Industrial Revolution.

It is evident from the foregoing that collaborative robots, also known as co-bots, are a recent development. Therefore, there are several issues surrounding them which are still under research and innovation. Sherwani et al. (2020) argued that the focus of the majority of research initiatives on collaborative robots is the safety of their human colleagues. As more robots move away from confined to normal workspaces, humans are experiencing robotics technology at a new and different level. The new cyber–physical interactions have triggered new concerns, fears and questions in the workspace. How should human workers treat co-bots? Are they tools or colleagues? Are co-bots trustworthy? What would make co-bots more acceptable as colleagues? Would human co-workers feel safe working with co-bots? What makes co-bots likeable or unlikeable by their human colleagues? There is a need to think these issues through as more robots enter the workspaces. Given that it is unlikely that robots can no longer be kept away from the workspaces, it is prudent that conversations about these issues are conducted promptly, transparently and comprehensively. This chapter focuses on the perception of co-bots, as either tools or colleagues, by information professions. It is part of the ongoing conversations on how to improve the acceptability of co-bots in the information workspaces. A future is visualised where robots and humans will be inseparable in a concept known as symbiotic autonomy, where bots and humans cannot do without each other (Bollegala 2016; Brandom 2016).

Methodology

The study anchoring this chapter was qualitative. This research approach was considered suitable for this study because it enabled the author to understand the perception of co-bots from the perspectives of the respondents (Kahlke 2014). It also enabled the collection of more points of view than would be possible through other means. The research design used was an exploratory survey. This design was preferred because co-bots involve new technologies (Saunders, Lewis and Thornhill 2009). Similarly, it was also suitable because the purpose of this chapter was not to make concrete conclusions about co-bots in the workplace but to stimulate further conversations about the subject (Brown & Brown 2006).

The population of the study consisted of professional librarians and records managers in Kenya. The actual 20 participants were selected through information-oriented purposive sampling. Primary data were collected through telephonic interviews guided by a semi-structured interview schedule. The interviews sought answers for the following questions:

1. Are there any co-bots operating in the information workspaces in Kenya?
2. What is the perception of co-bots by information professionals in Kenya; are they tools or colleagues?
3. What are the potential roles of co-bots in Kenya's information workspaces?
4. What would it feel like for information professionals to work with a co-bot as a colleague?
5. What would be the potential reporting relationship between human information professionals and co-bots in their workspaces?
6. Would co-bots have any stakes and/or loyalties to the information profession or society?

Secondary data were obtained through documentary analysis. The data were analysed thematically.

Benefits of co-bots in the post-modern workspace

Murashov, Hearl and Howard (2016) explained that the distinguishing attribute of collaborative robots is that they are designed to work in close physical proximity to humans. Therefore, collaborative robots are much smaller compared to their industrial counterparts. They are more flexible and can move easily in ordinary workspaces performing a wide variety of tasks. According to Sherwani et al. (2020), one of the features that have been introduced to enhance the safety of co-bots is safety-rated stop monitoring. This feature enables a co-bot to instantly stop movement when it encounters a human in its line of duty or operational workspace. This is achieved through

a combination of sensors and detectors. Other safety features in co-bots include the use of gestures to reduce physical contact with people as well as restrictions on the amount of force and speed a co-bot can use in respect to the location of the human co-workers.

According to Sherwani et al. (2020:2), co-bots are needed in human workspaces 'because the strengths of humans are the weaknesses of robots and the other way around'. Thus, when humans are working with co-bots, they complement each other and produce better results than when working independently. Oistad et al. (2016) argued that as opposed to industrial robots that were perceived as replacing human labour, co-bots complement and leverage human labour. This is largely because co-bots assist their human co-workers by performing the dirty, dangerous or dull (3D) jobs. Beetz et al. (2015) concurred that co-bots can support their human colleagues by performing mundane and health-threatening tasks and producing superior results. Moniz (2013) also explained that human job profiles will improve when co-bots take up the dull, dirty and dangerous jobs from their human counterparts. Thus, working with co-bots facilitates the realisation of better health and increased safety of the human workforce, reduced operating costs, faster production cycles and reduced downtimes (Sherwani et al. 2020). Tingley (2017) further explained that co-bots have great potential because they are designed to be collaborative. This means that they do not take away anyone's job but work alongside them, performing shared duties to increase productivity and financial gain.

Flacco and DeLuca (2013) explained that society can get more benefits from the collaboration between robots and human beings in situations where the physical distance between the two is eliminated or reduced. Indeed, and as stated earlier, Sauppé and Mutlu (2015) asserted that collaborative robots are designed to work alongside humans. Eder, Harper and Leonards (2014:1) argued that co-bots have skills that complement those of their human counterparts, thereby making it easier for them to accomplish tasks that are 'frequently changing, varied or imprecise tasks, with strength, precision, endurance and limitless capacity for repetition'. Andersen, Solund and Hallam (2014) explained that one way of integrating robots in the human workspaces is designing them in such a way that instructing them will not require expert robotics skills. The need for expert skills in programming or reprogramming robots has limited their use in normal working spaces, including small and medium enterprises (SMEs). Agility in robotics can be achieved by shifting from robot programming (done by experts) to robot instruction (done by non-expert co-workers).

Collaborative robots offer increased productivity, flexibility, versatility and safety (Sherwani et al. 2020). According to Tingley (2017), co-bots have the potential to remove the boundaries between occupations for the genders.

For instance, female workers can collaborate with co-bots to perform tasks that generally require the muscle power of the male gender. Through this, even the most tedious of manufacturing jobs do not have to be sweaty and greasy.

Collaborative robots are already being used in myriad fields of work. They help in providing better medical services by supporting doctors to perform complex surgeries. In manufacturing, they perform innumerable tedious tasks such as picking, packing, welding, assembling and handling materials with precision (Sherwani et al. 2020). In homes, they perform tasks such as teaching children, giving company to the old, cooking and cleaning (Oistad et al. 2016). By performing these tasks alongside their human counterparts, collaborative robots fit well in the context of the Fourth Industrial Revolution (Industry 4.0), which is anchored on seamless cyber–physical interactions of people and things to ensure superior performance and productivity. Therefore, the growing ubiquity of connected things in the context of the IoT, for instance, is a significant driving force towards the realisation of Industry 4.0.

In spite of the benefits of co-bots, there are concerns about safety in the human–robot co-working environment (Hayes & Scassellati 2013; Sherwani et al. 2020). According to Solaiman (2017), there are some cases where robots have caused harm to humans. In fact, robots are known to have caused the deaths of many people worldwide. Alemzadeh et al. (2016) reported that between 2000 and 2013, at least 144 deaths and 1391 injuries were caused by robots in the United States alone. Although statistics from other countries are unclear, human deaths and injuries from robots are bound to increase with the growing ubiquity of robots in workspaces and homes. Eder et al. (2014) argued that one of the concerns hampering the realisation of appropriate safety measures in human–robot collaborative working is the lack of standards for safety assurance. Other concerns include fear of job losses (Burke et al. 2006; Holder 2018; Sherwani et al. 2020), augmented psycho-social stress levels for humans working in close proximity with robots (Romero et al. 2018), increased environmental degradation emanating from a growing number of machines and technological clutter in workspaces (Mercier-Laurent & Monsone 2019), potential errors and inaccuracies arising from the possible malfunctioning of robots as machines (Maggi et al. 2017) and intrusion of the privacy of humans by co-bots working in their spaces (Jain et al. 2018).

Co-bots in the infosphere

The infosphere is the world of data, information and knowledge, as well as the systems through which they are created, shared, used, stored and perpetuated. The term 'infosphere' was coined by Boulding (1970), who viewed it as one of the six spheres in his environment. The other spheres were the sociosphere, biosphere, hydrosphere, lithosphere and atmosphere. He claimed that each individual is a node connected to a network of 'inputs and outputs of

information' (Boulding 1970), symbols and language. He argued that the infosphere then consisted of 'inputs and outputs of conversation, books, television, radio, speeches, church services, classes, and lectures as well as information received from the physical world by personal observation' (Boulding 1970).

Floridi (1999:8) explained that the infosphere consists of a 'macrocosm of data, information, ideas, knowledge, beliefs, codified experiences, memories, images, artistic interpretations, and other mental creations'. Uschold et al. (2003:882) argued that the infosphere is 'a platform of protocols, processes and core services that permit stand-alone or web-based applications to submit, discover and share information over a network'. Floridi (2001) argued that the infosphere is not a geographical, social, political or linguistic space. Conversely, it is borderless and cuts across nations, cultures, religions or generations. Floridi (2008) argued that the infosphere provides access to the foundational information reality in the universe. People's access to the infosphere is mediated by their capacity to explore and discover it. Therefore, the infosphere may be perceived as unsettling or empowering depending on the individual's information-seeking behaviour and information-processing capacity. Ellis (2016) explained that the infosphere is a convergence of the traditional and emerging media. O'Hara (2012) argued that it is the complete information universe. This view echoes that of Vlahos (1998), who argued that the infosphere is a blend of culture and technology to create an information ecology in which people can meet and access information anywhere, anytime, much more than they do *in situ*. Floridi (2012) explained that the infosphere is a complex information environment consisting of both natural and artificial agents. The ideal infosphere should be safe, accessible and equitable to enhance information welfare (Kwanya, Stilwell & Underwood 2013). From the foregoing descriptions, the infosphere is created and sustained by dynamic, versatile and complex interactions between technology, people and objects in the physical world. The infosphere is the arena of Industry 4.0 in which the boundaries between the physical and cyber worlds are blurred. Co-bots are one exemplification of this complex interaction between things and people in the modern infosphere.

There is already a wide array of robots in the infosphere. In libraries, for instance, Phillips (2017) explained that robots are being used to unpack, sort and shelve books. Other tasks performed by robots in libraries include security, user support, conducting library tours, reading stories for children, cleaning library premises, assisting persons with disabilities and training of new users. Cotera (2018) argued that libraries are already using technologies such as augmented reality, virtual reality, immersive reality, sensory immersion, gesture recognition, humanoid robots, mobile app and gamification to transform the delivery and user experience with their services. According to Graham (2019), libraries can employ shelf-reading robots, telepresence robots, humanoid

robots and chat-bots. Examples of robots already being used in libraries include Apple's Siri, Amazon's Alexa, IBM's Watson, G4S's Bob and Aberystwyth University's Hugh, among many others. There are also several chat-bots supporting libraries globally to provide reference services, respond to user queries or provide user orientation. Tella (2020) explained that robots ease space constraints and make library materials easily accessible. The bulk of co-bots in the infosphere is likely to be used in libraries. Indeed, Frey and Osborne (2017) classified librarianship as one of the jobs at high risk of being automated through robots. This implies that in future more library jobs may be done by machines, including robots. However, Phillips (2017) pointed out that robots will not be the only technology that would threaten library jobs. Nearly all technologies through the generations have impacted library work. Librarians have always coped with these and found new ways to fit the emerging technologies into their work. Therefore, Tella (2020) observed that the use of robots in libraries will not necessarily lead to job losses because the machines will only complement the work of human librarians. Omame and Alex-Nmecha (2020) added that the use of AI in libraries would help the institutions to do more rather than taking away the jobs of human librarians. Chemulwo and Sirorei (2020) asserted that 'acceptance and integration of AI into library services is indeed possible and beneficial' (Chemulwo & Sirorei 2020).

The other function in the infosphere which is likely to host many co-bots is records management. Here, the use of robots is encapsulated in the concept of intelligent records management. According to Kim, An and Rieh (2017), intelligent records management involves the use of AI to enhance the identification, classification and general management of records. Dieden (2019) argued that AI can naturally pair with records management officers to enhance efficiency, speed, accuracy and streamlined processes involved in registries and at records centres. Robots can work as messengers delivering memos, scan paper documents, perform filing tasks with precision, attend to people seeking, retrieving or returning files from registries and generally move documents around records centres and offices. Robots can also lift bulky documents in records centres or warehouses and can withstand the health challenges associated with working in dusty spaces. This will enable organisations to reduce risks, improve productivity and maximise compliance. Intelligent records management functions may include automated classification of records, metadata management, use of machine learning to build relationships between records or documents, use of natural language processing in requesting for documents from machines or automating the capture of records and developing rules to automate repetitive tasks. Wilkins (2019) argued that intelligent records management has shifted the focus of the function from facilitating compliance to more strategic business roles, thereby bringing records managers to the 'table' of decision-making in organisations. Recognising the fact that seats at the decision-making table

are reserved for persons involved in driving the strategic mission and vision of the organisation, records managers can only find their way there by performing strategic rather than operational (routine) roles. In the emerging infosphere, therefore, co-bots are likely to take the routine and tedious tasks from records managers and thus free them so that they can be involved in strategic roles. Quackenbush (2019) predicted that records management will no longer be about controlled file rooms and registries. Conversely, it will be about asset management and value preservation. This will be achieved by using intelligent systems to enhance the usability of records. Quackenbush further explained that there is a lot of data which people are unable to identify, find or use. He asserted that the next generation of records managers must address this challenge using intelligent processes and tools.

The number of co-bots in the sub-Saharan infosphere is unknown, but it is generally perceived to be low. For instance, Odeyemi (2017) stated that libraries in Nigeria were yet to harness the potential of robotics in delivering services. This situation was attributed to poor funding, intermittent power supply and weak telecommunication infrastructure which constrain the use of advanced automation systems in academic libraries in the country. The Nigerian situation mirrors the scenario in many other sub-Saharan African countries, including Kenya, where no robots have been deployed in the infosphere. In sub-Saharan Africa, University of Pretoria's robot employee, known as Libby, seems to be the only and most prominent co-bot. Indeed, Thekiso (2019) argued that this was the first and only robot deployed in a university library in sub-Saharan Africa. Doyle (2019) explained that Libby gives answers to basic questions about the library; markets library services, products and events; and conducts user surveys, for instance, about the level of satisfaction of the users with the library services. In spite of the low number of known co-bots in sub-Saharan Africa's infosphere, there is great potential for these machines. It is therefore the right time to discuss issues around perceptions of co-bots and how they are likely to impact professional information work in the not so far future.

Robots in Kenya

Kenya is one of the countries in sub-Saharan Africa which are seeking to transform their economic sectors through innovative use of emerging technologies. After the hotly contested general and presidential elections in 2017, the government summarised its development targets in the 'Big 4' agenda. According to Kenya's Office of the President, the 'Big 4' agenda are development targets aimed at improving the national socio-economic status and well-being of the citizens by enhancing manufacturing, improving food security and nutrition, attaining universal healthcare coverage and providing affordable housing to the citizens (GOK 2017). The government is seeking to

mainstream the use of AI, machine learning and robotics in achieving the 'Big 4' agenda (Wasonga 2019). To this end, diverse efforts are being made by different government agencies to identify, acquire or develop and deploy various technologies to improve national productivity and service delivery.

Theuri (2020) reported that in the wake of the inadequacies in Kenya's health sector exposed by the COVID-19 pandemic, Mission Excellence Global Service Limited, a Kenyan firm, has partnered with an Indian company to develop a medical co-bot known as Robodoc which is capable of scanning temperature and pulse levels, as well as asking pre-programmed questions. The robot will use facial recognition so that once information is captured, it gets stored in the hospital management system for future reference. Theuri (2020) further reported that the robot will also be able to virtually connect to a doctor for patient consultation and printing of prescriptions. Robodoc will help in keeping front line doctors and nurses safe as they deal with COVID-19 infections. As of 11 July 2020, three health workers had succumbed to the pandemic.[4] Efforts to launch robots in the delivery of health services are likely to gather momentum in the wake of growing risk levels occasioned by infectious diseases such as COVID-19.

Little is known about the use of industrial and other robots in Kenya (Magachi, Gichunge & Senaji 2017). Nonetheless, anecdotal evidence points to basic robot use in the country. Examples are few, but the most recent was in October 2019 when robots were deployed by the Kenya Navy to help locate a car that had plunged into the ocean with a mother and her daughter. The Likoni channel in Mombasa, Kenya, which the car plunged into, proved too dangerous for divers to work unaided. Because of secrecy of defence matters, the type of robot or how it was actually used in this case remain unclear to the public. It is because of the lack of such information that authors like Wambugu (2019) opined that Kenya, just like many countries in sub-Saharan Africa, is far behind in embracing robots in its economic sectors. Currently, it seems the majority of robotic solutions lie in basic machines such as automated teller machines, traffic lights, smart security cameras and drones.

Magachi et al. (2017) investigated the likely contribution of industrial robots to the competitiveness of listed manufacturing companies in Kenya. They concluded that industrial robots are not economically viable and do not provide a realistic solution to securing the immediate competitiveness of manufacturing firms in Kenya. This conclusion was based on the understanding that Kenya's economy is characterised by low wages and a youthful population, unlike the case in developed countries. From the predictions by this study, it is unlikely that many manufacturing organisations will deploy robots in the short term. In spite of the low use of robotics in Kenya, there are already fears

4. See https//www.the-star.co.ke/news/world/2020-07-11-2-more-health-workers-succumb-to-virus-kmpdu/

that the increased use of these machines may lead to unprecedented job losses. This fear is based on the understanding that the price of robots is falling while labour costs are rising every year. Therefore, more companies are likely to resort to using more robotic than human labour in the long term. The challenges in the use of robots in Kenya are not limited to labour issues only. There are also consumer-related concerns. According to Koigi (2019), Kenyan bank customers prefer traditional services offered by humans to those offered by robots. Koigi reported that about 80% of bank customers in Kenya have not warmed up to the idea of robots handling their banking needs.

In spite of the challenges, Kenya stands a great chance of adopting emergent technologies like robots. Many developments in the country's technological landscape point to a higher potential uptake of advanced technologies. Already, Kenya is leading in digitalisation and is producing technological innovations which are creating an environment that is conducive for increased integration of co-bots (Root 2020). Kenya's capital, Nairobi, is considered the 'Silicon Savannah' because it is the home of globally celebrated technological innovations such as a mobile money transfer platform, M-pesa, among others. The ICT sector in the country is also well-developed. For instance, the country is reputed for having one of the best Internet connections in Africa because of the number of undersea cables which land in it. Kenya also boasts of the latest technologies in its economy. There is a dominant presence of multinational ICT companies, implying access to the latest technologies, a growing population of young people amenable to technological developments, a relatively well-educated population (adult literacy is about 78%) and a history of innovation. Nonetheless, digital connectivity is concentrated in the capital, Nairobi, and a host of other urban centres. Rural areas, where the majority of the populace lives, do not have adequate access to digital technologies.

Kwanya (2014) argued that the technological environment in Kenya is improving rapidly. The latest statistics from the Communication Authority of Kenya (CAK) (2020) indicate remarkable digital growth. The statistics from CAK (2020) show that as of 31 March 2020:

> [*T*]he number of active mobile subscriptions in the country stood at 55.2 million translating to mobile penetration of 116.1 percent. Similarly, the number of active registered mobile money subscriptions stood at 29.1 million while the number of active mobile money agents stood at 202,102. Total undersea bandwidth capacity leased in the country increased by 14.1 percent to stand at 7,123.36 Gbps from 6,241.84 Gbps recorded in quarter two. EASSy cable lit capacity by 5x100G + 38x10G activations, hence the increase in total lit capacity. (p. 22)

Nitsche (2019) argued that Kenya has one of the best innovation ecosystems in sub-Saharan Africa, with home-grown success stories driving the adoption of emergent technologies. She further explained that increased access to e-citizenship services, super-fast Internet speeds and home-grown digital

innovations have made Kenya a digital first society. Mputhia (2019) explained that the selection of Kenya to host the World AI Show in 2019 was an indication that the country is likely to be a major robotics destination in the near future.

Tools or colleagues?

Borrowing from the words of Ezer (2008), this chapter addresses pressing questions regarding the nature of co-bot and human relationships in the workplace. Can co-bots be considered as colleagues, teammates, friends or merely as appliances and tools? According to Sauppé and Mutlu (2015), co-bots are more than physical machines because they are also considered as social entities to which attributes such as personality, feelings and gender are ascribed. In fact, Solaiman (2017) suggested that co-bots should be accorded the status of legal persons capable of suing or being sued. It is therefore not surprising that, as reported by Mputhia (2019), a humanoid known as Sophia was given Saudi Arabian citizenship in 2017. Beck (2016) also argued that giving co-bots the status of a legal resident would enable them to be held responsible for their actions and decisions. Furthermore, as legal residents, it may be possible to implement what Bartneck, Reichenbach and Carpenter (2006) suggested earlier, that co-bots should be paid wages for work done. Mputhia (2019) argued that one of the issues being discussed is whether co-bots, as legal residents, can also enjoy intellectual property rights such as patents. Can co-bots be recognised as inventors and awarded patent certificates? If co-bots can be recognised as creators of original works, can they also infringe intellectual property rights? Opinions on these questions and concerns from Kenyan information professionals are presented and discussed further.

Co-bots in Kenya's infosphere

From interviews conducted with information professionals in Kenya, it emerged that there were no co-bots in information and knowledge centres in Kenya. Asked about when co-bots, including co-bots, may be expected in Kenyan information spaces, the information professionals had varied opinions on the timelines. However, there was consensus among them that there are unlikely to be any co-bots in information workspaces in Kenya in the next five years because no institution is known to have included the purchase of such machines in their current strategic plans, which ordinarily run for a minimum of three years and a maximum of five years. Knowing the adventurous spirit of Kenyan innovators, as reported earlier, it is possible that there may be some provisions for co-bots in librarianship or records management roles in the next cycle of the strategic planning process. One respondent stated:

> 'It is not possible to accurately predict when we will have co-bots in our workspaces. Think about the past ten years. Is there anything so remarkable that has happened since then? Since 2010, what life changing occurrences have come to pass in information management professional practice? There may be few basic co-bots in the next five to ten years.' (IP20, age undisclosed, 2020)

Perception of co-bots by information professionals in Kenya

On matters related to perception, information professionals in Kenya hold the view that co-bots are machines and therefore cannot be treated as legal or artificial persons. They explained that there is a clear distinction between the co-bots and the human information workers. In their view, this distinction is so clear that co-bots can only be considered as tools that human information professionals use to perform selected tasks. As tools, co-bots do not and cannot enjoy any rights reserved for humans. For instance, tools cannot innovate and therefore cannot be rewarded or recognised for performing what they are programmed to do. The information professionals in Kenya wondered how a co-bot that is patented to an innovator can also claim intellectual property rights, including patents. They concluded that this is illogical and impractical. They also explained that co-bots, as artificial entities with no personal needs, do not need wealth or favour. They are tools purchased by owners to perform specific tasks; they have no needs in and of themselves. For instance, they have no families to take care of or children to take to school. They do not need housing, food or clothing as human workers do. Similarly, they have no descendants to save inheritance for. Therefore, they do not need and are unlikely to appreciate any form of remuneration.

The perceptions of co-bots by Kenyan information professionals concur with those found in the literature. Hug (2019) argued that the perception of co-bots as artificial companions as opposed to automated tools plays a significant role in increasing the acceptance of co-bots as work colleagues. Dautenhahn et al. (2005) conducted a study on the acceptance of co-bots and found that many people would hesitate to accept co-bots as colleagues. They explained that co-bots cannot be relied on to perform tasks alongside human beings because they are perceived as dangerous and unpredictable. Khan (1998) conducted a study in Sweden to identify the roles people were willing to assign to collaborative co-bots. Most of the participants in the study stated that they would assign mechanical duties such as cleaning or moving heavy things to co-bots. However, they would not trust a co-bot to watch over a baby (or pet), read aloud, cook food or take care of kitchen goods. Dautenhahn (2007) explained that these reservations about the roles humans are willing to assign to co-bots emerge from the perception that regardless of their level of intelligence, co-bots are not people.

Given that the use of co-bots is inevitable in the infosphere in Kenya and other developing countries, there is a need for strategies to increase their acceptance by human professionals. While promoting co-bots, there is a need to understand the factors that influence humans to accept them. Ezer (2008) explained that younger people are likely to view co-bots as colleagues, while the older people are likely to view them merely as machines regardless of the functions they perform. Ezer suggested that the level of experience with technology also pre-disposes people to perceive co-bots positively. Therefore, tech-savvy individuals are likely to accept co-bots as colleagues compared to those who are less tech-savvy. There is also a gender angle to co-bot acceptance. Bartneck et al. (2007) argued that women with appropriate exposure to co-bots typically have a very accepting attitude towards co-bots as compared to men. It seems, therefore, that introducing co-bots successfully in human information workspaces in Kenya will be easier if young and tech-savvy women are involved as frontrunners in their organisations. Recognising the fact that most information workers in Kenya, particularly librarians, are women (Kwanya, Kibe & Owiti 2016), it is likely that the negative perception regarding co-bots will change positively in the future as more human workers deal with them practically.

Perceptions of job roles of co-bots

Information professionals in Kenya acknowledge the need for co-bots to enhance their productivity and efficiency in service delivery. They, however, asserted that co-bots in the information workspace are supposed to take up the dirty and dangerous tasks from human professionals so as to free them to concentrate on more strategic roles. They explained that they (humans) do not expect to sit down with co-bots to develop strategic plans, resource mobilisation strategies or budgets for their functional units. They argued that however intelligent a co-bot is, it cannot demonstrate the human thought process and discretion in handling work apart from routine assignments. This upholds the perception of co-bots as machines operated by humans, albeit in varying degrees, to make the work assigned to the latter easier. They reasoned that co-bots are expected to help humans and not vice versa. They also said that now the priority in Kenya is not to concentrate on complicated co-bots but opt for basic co-bots to help human workers with labour-intensive tasks. This opinion from one respondent is summarised in the following verbatim statement from one respondent:

> 'What we need now in Kenya are not co-bots which will require us to consider them as colleagues entitled to human and other rights. We need basic machines which we can use to make our work easier and efficient.' (IP9, age undisclosed, 2020)

Asked about whether they would be comfortable interacting with co-bots in their workspaces, information professionals in Kenya explained that they

would be comfortable as long as their safety is assured. They added, however, that they would not trust a co-bot completely. These views mirror those prevalent in literature. For instance, Nomura, Kanda and Suzuki (2006) investigated the feelings of Japanese university students towards co-bots. They found that all the students expressed anxiety, nervousness, helplessness and fear when they imagined having co-bots in their everyday life. The anxiety revolved around the perceived unpredictability of co-bots in their interactions with humans. Other causes of anxiety included the perceived extent of trouble or damage co-bots can cause, lack of complete reliability in the practical aspects of human life and their inadequacies in the social realms of human interaction. This level of anxiety determines the degree to which individuals would welcome co-bots to their personal, social or work spaces. Some verbatim responses from the information professionals in Kenya in this regard are hereunder:

> 'Can you imagine what would happen if the co-bot "runs mad" and fails to take instructions? The damage can be enormous.' (IP19, age undisclosed, 2020)

> 'As long as my safety is assured, I would not mind working closely with a co-bot. The only concern is that, unlike human colleagues, they have no moral judgment and can hurt people unintentionally.' (IP11, age undisclosed, 2020)

> 'Co-bots in the office cannot keep secrets as human colleagues do. I would not feel free with them knowing that co-bots can report all the secret happenings in the office and thereby put my job at risk.' (IP13, age undisclosed, 2020)

Kaplan (2004) explained that some people fear working with co-bots because they exist in the blurred distinguishing line between nature and culture. He opined that co-bots that resemble humans too closely might be terrifying. In fact, DiSalvo et al. (2002) suggested that as co-bots become more humanlike, their acceptance increases up to a critical point – also known as an uncanny valley – beyond which they instil fear, discomfort and uncertainty around them. This view is supported in a study by Dautenhahn et al. (2005), who found that many people would like to communicate with co-bots in a humanlike manner, but they do not want co-bots that look like them. Tingley (2017) explained that people's affinity for co-bots increases as they become more humanlike. However, the affinity plunges when the human-likeness becomes similar enough to fool the eye. Once this illusion is discovered, affinity plunges and is replaced with unease. Tingley argued that this unease is likely to affect the future use of co-bots in ordinary workspaces.

Another concern about the deployment of co-bots in ordinary workspaces is the fear of job losses. Information professionals in Kenya share this fear and explain that the use of co-bots will reduce job opportunities for human professionals. This view is in tandem with that of Acemoglu and Restrepo (2020), who explained that increased use of co-bots may reduce employability and wages of human workers. Furthermore, Phillips (2017) claimed that people

fear that co-bots may increase in number and knowledge to the extent that they may overtake and destroy humanity.

Co-bots are cold and dull to work with

Information professionals in Kenya also raised a concern about the possible impact of co-bots on the personality and behaviour of their human colleagues. They said that humans working with co-bots are likely to become as 'cold' as co-bots themselves. This view concurs with that of Savela, Turja and Oksanen (2018), who argued that increasing the deployment of co-bots in the workplace may lead to reduced interactions between human workers. According to Sauppé and Mutlu (2015), collaborative co-bots may be disruptive to the social environment in which humans work. They are aliens with no capacity to feel like humans. It is difficult to relate to them beyond job-related tasks. Workspaces are more than the spaces in which work happens. They are also spaces where co-workers interact and relate socially. A co-bot cannot crack jokes or carry lunch to share in the departmental potluck. It is just a piece of cold metal, plastics and wires. Their participation in the making of conducive work environments is limited. For instance, colleagues sometimes tell stories as they work. Many co-bots cannot multitask in this manner and are therefore dull to work with.

Information professionals in Kenya are also worried that they may not know what to do if something goes wrong with their co-bot. There are also fears that the co-bot may make mistakes when not being watched. Therefore, having a co-bot in the workplace is an additional responsibility for their human colleagues who have to keep checking on them as if they were little children. It is in this perspective that Solaiman (2017) argued that the risks associated with an increased presence of co-bots in the workspace call for careful consideration of the vulnerabilities of their human companions. Hereunder are some verbatim statements of the interviewed information professionals in Kenya about having to work closely with co-bots:

> 'Having a co-bot in the workspace is like working on two jobs at the same time since watching on the co-bot is another fulltime job besides your own. You take your eyes off it and you end up with myriad mistakes which may require repeating jobs or staring at life-threatening safety issues.' (IP12, age undisclosed, 2020)

> 'How can a co-bot be a colleague yet it cannot borrow your car, contribute in a fundraising, help you to mourn a family member or share a social drink after work?' (IP7, age undisclosed, 2020)

> 'The office workspace is more social than technological. There is more to being a colleague than mere physical proximity. It will be difficult for a co-bot, which is a machine without emotional intelligence, to fit in.' (IP3, age undisclosed, 2020)

> 'Working with co-bots will change our personality. We will become as cold as they are aster working constantly with them in our offices. This is not something we can look forward to.' (IP5, age undisclosed, 2020)

Job responsibilities and reporting structures between co-bots and human workers

Opinions in literature converge on the understanding that co-bots work with some degree of independence. Therefore, they do not necessarily require to be operated by humans. Consequently, in a work environment, both co-bots and humans are ideally assigned roles and responsibilities that they perform alongside each other. To this extent, they are not mere products or appliances. Conversely, they are employees in their own rights. The only difference between them and their human counterparts is the fact that they are intelligent machines. Thus, as Bartneck, Reichenbach and Carpenter (2006) argue, co-bots, just like their human counterparts, should be praised or punished depending on their performance. Working independently of each other mirrors the normal human working associations where employees consider each other as co-workers or colleagues. Co-bots are engaged in workspaces as employees and not just as tools. Under these circumstances, humans can reasonably consider them as colleagues. Information professionals in Kenya concurred with most of the views above. However, they argued that co-bots cannot work independently without human involvement. A human being will still need to switch them on, change or charge their batteries, give them instructions and otherwise maintain them. The fact that co-bots are not equal to humans in intelligence and problem-solving means that there is a very rare possibility that they will meaningfully be considered as colleagues by human workers.

Asked whether they would accept a co-bot supervisor, the information professionals responded with an emphatic no. They explained that given the fact that co-bots are machines, there is no way they can be considered superior to human workers to the extent that they can supervise them. Although Oistad et al. (2016) argued that hierarchy might disappear when humans and co-bots work together as colleagues, Ezer (2008) was of the view that human beings often consider co-bots as playing a supportive role. Therefore, Ezer further argued that co-bots cannot be considered to be at par with their human counterparts, leave alone supervising them. Co-bots are only helping humans to perform tasks that are arguably not their own; they are essentially assistants to human workers. Some verbatim responses in this regard from the information professionals interviewed are as follows:

> ‘Co-bots will expose inefficiencies of human workers. I will most likely make more mistakes than they do while performing the same or similar tasks. I don’t think my job will be safe in the presence of a co-bot.’ (IP15, age undisclosed, 2020)

> ‘Human beings are superior intellectually to machines. Therefore, it is illogical to think of having a co-bot to supervise a human being. If the co-bot and the human being have to be at par, then the co-bot should be given its own assignments while the human beings also do theirs. The results can be integrated into one process

> in such a way that neither the co-bot or human takes instructions from the other.' (IP11, age undisclosed, 2020)
>
> 'The reporting structure between co-bots and human workers should be pretty obvious. The human being is definitely the boss. Co-bots cannot work at the same level with human beings leave alone supervising them.' (IP17, age undisclosed, 2020)

Co-bots have no stake or loyalty to employing institutions and society

Data from interviews with information professionals in Kenya as well as from literature point to an apparent reluctance by humans to accept co-bots as colleagues in information workspaces. They do not foresee a future in which co-bots can be treated as legal residents with obligations, needs and rights similar to human beings. This is partly because co-bots have no stake in the institutions they 'work' in. They do not care whether the company is making losses or profits. In fact, they have no clue about such issues. Thus, they do not depend on the employer or the job for their survival or well-being. They can be purchased by another employer any time and would owe nothing to their original owners. Similarly, they cannot share in the needs, concerns or fears of the people who work with them. They have no feelings of friendships, loyalty or hate. They have no ambition, dreams or fears. While these attributes may be the same ones that make co-bots perform better and consistently, the same make human workers unwelcoming to them. Therefore, the end of the debate on whether humans ought to treat co-bots the same way they treat their human colleagues is not in sight. As has been explained, there are advantages and disadvantages in either approach.

Conclusion

It is evident from the foregoing discussion that co-bots are increasingly being introduced in the normal workspaces. The infosphere, just like the other spheres, will soon witness a dominant presence of co-bots. Many people are still uneasy about working with robots as colleagues. The factors influencing this unease include fear of job losses, safety concerns about working in close physical proximity with robotic machines, lack of trust in co-bots to perform duties alongside humans without having to be operated and ethical issues about 'who' robots are or can be. As Kenya makes progress towards the Fourth Industrial Revolution, it cannot avoid conversations about opening up the workspaces for robots to increase the productivity of its economic sectors. Therefore, there is a need for research and evidence-based discussions regarding the place of robots in the modern workplace.

There is a need to sensitise information professionals in Kenya about co-bots and how they can be used in the infosphere to transform service delivery. There is also a need to assure information professionals that the main objective of introducing co-bots in the infosphere is not to replace human labour. As already explained, co-bots augment human labour to create better results and productivity. It is in the interest of human workers to embrace co-bots and work together with them to enhance their individual and corporate performance. The socio-economic environment in the Fourth Industrial Revolution will be so complex and competitive that human labour alone will not be sustainable. This sensitisation may be done in terms of research, awareness creation and demonstrations of what co-bots can do as well as what it means for the human information professionals to work with them.

For co-bots to be accepted as colleagues by information professionals, there is also a need to assure the human workers that robots can be team members. As suggested by Nikolaidis and Shah (2012), co-bots and their collaborating human colleagues should execute tasks in the same way using a similar mental model of execution to work effectively as a team. Andersen et al. (2016) also suggested that both humans and their co-bots need training on how to collaborate effectively in performing their duties. Another issue that needs to be addressed, according to Alemzadeh et al. (2016), is difficulty in skills transfer between robots and human beings. Better collaboration will be achieved if there are mechanisms for robots and human colleagues to share skills that are essential for their collective work during task execution through social learning. Similarly, emotional intelligence is critical for robots to join and belong to work teams with humans. Other requisites include intention recognition (requires synchronised communication enabling the establishment of expectations); sharing of roles, responsibilities and tasks; defining how to handle unfulfilled commitments or varied delivery timelines and mechanisms to handle co-worker disengagement or poor performance (Hayes & Scassellati 2013).

Co-bots and their human counterparts also need to develop a working relationship to be able to operate together effectively. This relationship can be built and sustained by mutual trust between the co-bots and their human colleagues. Sarkar et al. (2017) explained that there is a need for trust between human workers and their co-bots for effective collaboration. The authors emphasised that achieving trust is one means of ensuring acceptance of robots as co-workers by humans. This will ultimately pave the way for their widespread adoption in workspaces of the future. Trust enhances collaboration, decision-making, dependability, credibility and general acceptance. Bollegala (2016) argued that technical possibilities should not be the only considerations in robot design and deployment. Ethical, moral and social issues must also be considered. Acceptance of technology is an important element

of technological feasibility. Oistad et al. (2016) suggested that workers would like co-bots to be anthropomorphic, social and interactive. Co-bots that look and behave like humans have the potential to be liked more and welcomed by human colleagues than mechanical robots. The more similar they look and behave like humans, the better the attitude of humans towards them in terms of cooperation, openness and interaction. Mechanical robots are more likely to be viewed as tools than as colleagues.

There are no co-bots in the Kenyan infosphere at the moment. Therefore, the primary data presented and discussed in this chapter are not entirely based on actual reality but on future possibilities. The perceptions of co-bots expressed here may change when the information professionals interact with them in real life. Again, relying on the views of only 20 information professionals, as key informants, may not be representative of the views of all the other workers in the Kenyan infosphere. In spite of these limitations, the views in this chapter have been strengthened by anchoring the same on literature from environments in which co-bots already exist. It is unlikely, therefore, that the views and experiences of Kenya's information professionals would be remarkably different from the others in different national environments. This chapter, therefore, provides arguments that can reliably shape discussions on the future perceptions of co-bots in Kenya's infosphere.