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Service Robots and the Future of Services

Stefanie Paluch, Jochen Wirtz and Werner H. Kunz

Summary

We believe that our economies are facing a turning point in history similar to the industrial revolution in manufacturing that started in the 18th century. Especially the advent of service robotics (virtual and physical service robots) in combination with these technologies will lead to rapid innovation that has the potential to dramatically improve the customer experience, service quality, and productivity all at the same time. Service Robots are on the rise and alter the organizational frontline. Based on the Service Robot Deployment Model (SRD), we support managers in their choice decisions concerning which services and tasks robots are suitable to fulfill, and how they need to be designed so that customers are willing to engage in interactions. Furthermore, this article discusses several implications of service robots for the field of service management and marketing.

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Authors

Prof. Dr. **Stefanie Paluch** is Professor for Service and Technology Marketing at the RWTH Aachen University and Senior Fellow at the Hanken School of Economics, Helsinki, Finnland.

Prof. Dr**. Jochen Wirtz** is Professor of Marketing and Vice Dean Graduate Studies at NUS Business School, National University of Singapore.

Prof. Dr**. Werner H. Kunz** is Professor of Marketing and Director of the Digital Media Lab at the University of Massachusetts Boston (USA).

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1 Introduction

Robots and Artificial Intelligence (AI) have inspired Hollywood writers and directors since the beginning of the 20th century to capture this topic on celluloid[1]. At the beginning, until the middle of the 20th century, that was pure fiction for the audience of these artworks which in no way originated from the reality of their lives. But now this fiction is moving into people's everyday lives in the wake of rapidly developing AI (Kaplan/Haenlein 2019; Paluch/Wirtz 2020).

We are now at a turning point, where voice-based (Siri or Alexa) or humanoid robots (Pepper) come into our daily lives. Due to the rapid advancements of robot technologies in combination with AI, big data analytics, cameras, sensors and speech recognition, so-called *service robots are on the rise* (Jörling et al. 2019; Wirtz et al. 2018). They are capable of performing tasks autonomously without any human involvement (Colby et al. 2016), execute tasks by following their service-script (Huang/Rust 2018), and with prior knowledge are said to be an important source of innovation (Rust/Huang 2014). In this article, we particularly focus on the organizational frontline, on the point where the service is actually delivered to the customer, using the following definition: *Service robots are system-based autonomous and adaptable interfaces that interact, communicate and deliver service to an organization's customers* (Wirtz et al. 2018, p. 909). Service robots are typically embedded in larger (virtual) networks that provide access to internal and external data. Autonomous robots have the ability to recognize and learn from their environments and make their own decisions without human intervention. With the help of cameras and sensors, robots can identify customers through facial or voice recognition and provide services according to customers' profiles, which they can access through the interconnectedness of systems.

Service robots provide businesses with new opportunities to reorganize their organizational frontline and serve their customers in new and innovative ways. However, managers and service companies need to understand *how service robots can be implemented at the organizational frontlines* and which pitfalls to avoid for their successful implementation. Based on the Service Robot Deployment Model (SRD), we support managers in their choice decisions concerning which services and tasks robots are suitable to fulfill, and how they need to be designed so that customers are willing to engage in interactions.

What we learned so far is that a majority of the *customers who are skeptical of robotized interactions* and have only limited experience with robots derive their understanding and attitudes concerning robots from movies and media and not from real life, especially since interactions with robots are still rare for many people. We, therefore, take a brief look into the world of movies to shed light on *how Hollywood deals with the interactions and complex relationships between humans and robots* and thus subliminally shape the attitudes of people towards human-machine interactions. Depending on the scope of the definition of robots, a

[1] We thank Thomas Wittkop (TH OWL) for his valuable insights on Hollywood Movies, Robots and Artificial Intelligence.

correspondingly longer or shorter list of science fiction motion pictures can be identified. The range extends from people with prostheses such as in the series 'The Six Million Dollar Man' (1974-1978) to cyborgs such as in the Robocop films (1987-2014) and the Terminator adaptations (1984 – 2019) to non-humanoid machines like in the Star Wars films (1977-2019) or 'I, Robot' (2004). From the beginning of the 20th century to the present day, it is estimated that there have been between 150 and 200 films in which robots appear in one of the above forms.

Many famous science fiction movies have been playing for years with scenarios of what happens to mankind and to the earth when AI in the form of robots or machines take over world authority. Very often in these scenarios, mankind is exterminated or has to leave the planet to settle in another galaxy. According to Bartneck (2013) there are only two archetypes that reflect the relationship of humans towards robots in the movies in a simplified way: Robots want to be humans as is shown in titles like 'Aliens' (1979), 'Blade Runner' (1982), 'Star Trek' (1994), 'A.I.' (2001) and 'Wall-E' (2008), or robots aim to kill all humans as in 'Terminator' (1984-2019), 'I, Robot' (2004) and 'Transformers' (2007). There is no trace of a common peaceful co-existence. But as in most cases, Hollywood movies are visionary, and we can probably nevertheless learn something about human and robot relationships.

2 Robots at your Service

The service industry shows deep interest in *experimenting with service robots*. For example, The Mandarin Oriental Hotel in Las Vegas has introduced Pepper as their newest humanoid staff member. Pepper resides in the lobby, where she welcomes guests and helps them to get directions. Her job is to provide information to *hotel* guests entertainingly and innovatively (Walsh 2018). The Henna Hotel in Japan is the first robot-staffed hotel and guests can choose to check-in with an android woman, a robot or a dinosaur robot (see **Figure 1**).

The luggage will be delivered to the room by a porter robot, and the concierge robot Tully will switch the light on and off for the guest (Kikuchi 2018). At *airports*, robots are used in the form of passenger guidance, for maintenance or for security. At Amsterdam Schiphol airport, the robot Spencer scans boarding passes of KLM passenger and helps them to find the right departure gate. Kate, a self-moving check-in kiosk robot, is working at Kansai airport in Japan and detects busy areas, autonomously goes there and helps passengers to reduce waiting times. At Incheon airport in South Korea cleaning robots vacuum the airport and in Shenzhen's Bao'an International Airport, Anbot, a security robot, patrols the departure hall for suspicious behavior (Read 2017).

Figure 1 Service Robots at the Reception of Henna Hotel in Japan

Source: Official Website Henna Hotel

Figure 2 Service Robots in different Service Industries

Source: (clockwise from upper left to lower left): Bejing Review http://www.bjreview.com/Nation/201609/t20160922_800068029.html, https://eandt.theiet.org/content/articles/2016/09/can-robots-handle-your-healthcare/, https://www.avidbots.com/automated-floor-cleaning-robots-gaining-popularity-around-world/, https://www.analyticsinsight.net/amazon-begins-its-autonomous-delivery-robots-in-california/

Further, societal changes such as an increasing share of elderly population and declining workforce infuse the use of robots in somewhat unexpected contexts, such as *nursing care*, which typically requires a more personal touch and individual attention. In Tokyo's Shintomi nursing home, robots help caretakers with lifting people, they perform exercises with a group of elderly residents or start enjoyable conversations (Foster 2018).

All the above examples demonstrate clearly that the service industry is changing (see **Figure 2**), and that more and more businesses consider *reorganizing their organizational frontline service* (Lu et al. 2020). Studies suggest that by 2025, 85 % of customer interactions will take place without a human agent (Schneider 2017). However, the question remains: how can companies make use of service robots?

3 The Service Robot Deployment Model

To answer this question, we need to contrast the *characteristics of service robots* with those of frontline employees. In this article, we only focus on three differentiating aspects (for a more comprehensive comparison, see Wirtz et al. 2018):

Emotional Touch vs. Customized Tech

It is common in service industries to say that the frontline employee is the face of the company. The service is determined by the personal skills, training, emotions, personality, and attitude of the frontline staff. Depending on company strategy, the *human touch can be the key differentiating factor* for service excellence. Personal service entails genuine real emotions between one human being and another. In contrary, robots are not able to feel and express real emotions. This is important as the service management literature distinguishes between deep acting (employee displaying true emotions) and surface acting (employee displaying superficial fake emotional response; e.g. Wirtz/Jerger 2017). Robots' emotional display is likely to be "fake" and displayed, not authentic and truly felt. Consumers are likely to know this, perceive it and respond accordingly. Thus, customers are unlikely to respond to robot-displayed emotions as they would to "heart-felt" and authentic emotional response of human frontline employees (Wirtz et al. 2018).

On the other hand, as robots do not have real feelings, they *can consistently be pleasant and are not prone to emotional burn-out* (cf. van Doorn et al. 2017). Thus, robots might perform better at displaying surface-acted emotions than human employees do.

Individual Person vs. System-Based Approach

Another distinction is that human employees are individuals with their own personality, skills, perceptions and biases, so *employees' service shows heterogeneity over time and across individuals*. Furthermore, employees need to learn the execution of the service processes and to memorize the relevant information. This process takes time and is not a seamless transition. Robots, on the other hand, are system-based approaches. They can be connected to

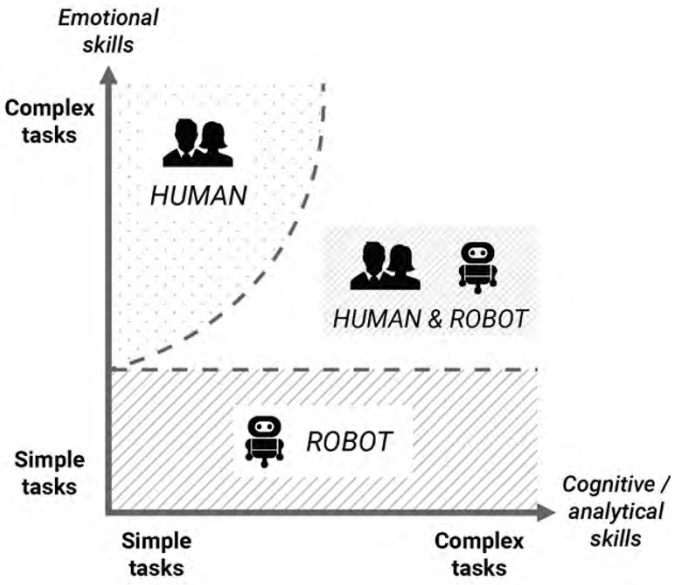
knowledge databases and use all available internal information (e.g., from CRM systems) or even external sources such as the Internet to provide their service.

High Incremental Cost vs. Low Incremental Cost

Finally, *human employees are not scalable*. Every person adds significant costs. In contrast, robots entail enormous economies of scale and scope, at least concerning the costs of research and development. Virtual robots (e.g., chat bots and robots with holograph interfaces) are likely to be deployed at no or negligible incremental costs (Wirtz et al. 2018). Although physical robots do have incremental costs, those amount only to small fractions of adding headcounts.

Given these typical characteristics of human employees and of service robots, respectively, companies need to *decide which types of jobs and tasks* human employees should execute in the future and which could better be handled by robots. For this decision, jobs and tasks can be sorted by their degree of being rather of cognitive and analytical or emotional and social nature. Depending on the combination of these two dimensions, Wirtz et al. (2018) propose the *Service Robot Deployment Model* to predict which task will best be done by humans, by robots, or in human-robot-collaboration (see **Figure 3**).

Figure 3 The Service Robot Deployment Model (SRD)



Source: based on Wirtz et al. 2018

Given the system-based approach as well as the decreasing costs of computer processing and of AI (i. e. Moore's law), robots have a clear advantage over human employees when it comes to cognitive and analytic work. On the other hand, human employees can provide the emotional touch of a service that is hard for robots to simulate, so these differences need to be taken into account *when tasks are distributed between humans and robots*. Some jobs in service might only need low cognitive/analytical as well as low emotional/social skills. Wirtz et al. (2018) assume that robots will be capable to mimic simple emotional and social tasks in the future, so that they will be a more cost-efficient solution than human employees (cf. Wirtz/Zeithaml 2018). On the other hand, jobs that require high cognitive/analytical and at the same time high emotional/social skills could best be delivered by humans supported by robots – robots will outperform humans in the cognitive tasks, while humans will provide the emotional side of the job (Lariviere et al. 2017).

4 The Right Robot for the Right Service

A persistent problem is that customers perceive service robots to be less skilled than human service employees. If companies are now considering an increasing use of service robots, they must also make sure that *service quality does not suffer as a result*. Customers may interpret this as primarily a cost-cutting measure and as a result might be reluctant to interact with service robots. We are currently still in a stage in which robots must prove their worth from the customers' perspective by adding tangible benefits, such as immediate and 24/7 access to customer contract centers, superior processes and immediately accessible product knowledge, and eventually even better problem solving skills as compared to the average call center service employee. In this current stage, companies and managers can do a lot right or wrong.

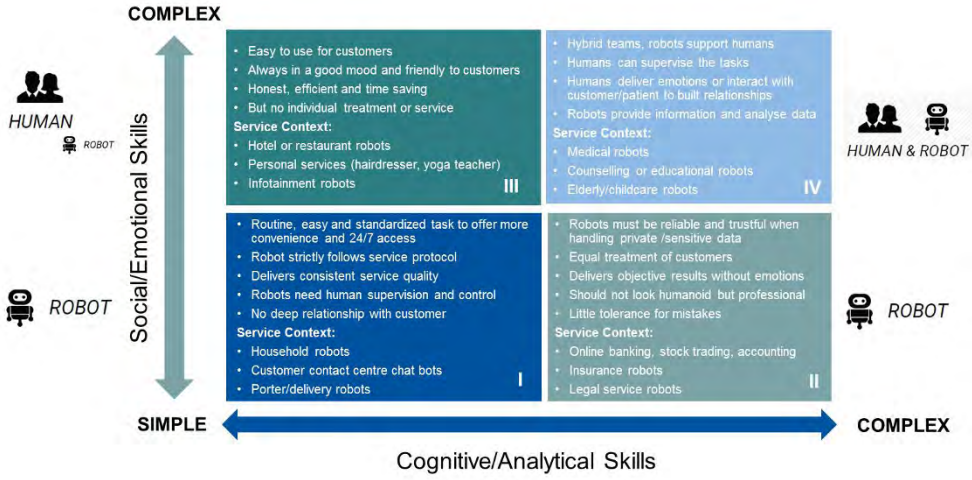
First, we need to *understand the different services types*. Therefore, we build on the matrix of Wirtz et al. (2018), in which service tasks are classified based on the level of cognitive/analytical skills and social/emotional skills (see **Figure 4**).

The underlying assumption is that robots benefit from AI and can, therefore, easier handle complex decision-making situations in which high-level cognitive/analytical skills are required. Humans, however, have the ability to feel and display real and deep emotions and are therefore better in dealing with services that require complex social/emotional skills.

For Simple Jobs take a Service Robot. In the first quadrant of **Figure 4**, where the needed cognitive/analytical as well as the social/emotional skills are low, service robots can perfectly take over tasks – such as vacuuming the floor, mowing the lawn, patrolling airports or delivering luggage to guest rooms, or providing information and executing transactions in customer contract centers. In these service contexts, customers' expectations regarding emotions or any form of active, human-type interaction is low. The most important thing is that the job is done efficiently and effectively, so the advantages of the robot outweigh possible human benefits, especially in terms of availability and delivering consistent high quality service. This category of service jobs might not be among the most popular amongst human

employees, and in times of labor shortages we recommend these tasks to be assigned to robots first. In some instances, it might be useful to have human supervisors who can support service robots in cases of exceptions.

Figure 4 Service Types and Required Skills



Source: modified and adapted from Wirtz et al. 2018

Let Robots do the Analytical Work. In the second quadrant, the required cognitive/analytical skills are high while the needed social/emotional skills remain low. Here we expect the demand for service robots to be high in the future. In professional service industries, such as insurance, accounting or in legal contexts significant amounts of information need to be analyzed quickly and customers require reliable results and objective recommendations without much sentimentalism. These analytical jobs are better done by robots. A great advantage from the customer's perspective is the equal treatment by robots because robots' decision-making is solely based on available information, so customer discrimination is less likely if the AI is programmed accordingly (Lobschat et al. 2020). Here, companies need to prioritize security and privacy concerns and communicate the transparency of the data usage, especially when robots work with sensitive customer information (Lobschat et al. 2020). It is also recommended to inform customers about changes in the frontline organization or about the technology that is used to deliver the services because a well-informed customer is able to appreciate changes.

When Real Emotions matter… In the third quadrant, tasks require high social/emotional skills and less cognitive/analytical expertise. Human service employees have superior skills to perform tasks in hotels, restaurants, airlines, retail or entertainment industries where the personal experience is central for customers. These services are characterized by a high

degree of interaction between the service employee and the customer, and service quality is often measured based on the service counterpart's behavior. Considering our examples at the beginning of this chapter, hotels, restaurants, and airports are areas where service robots are preferably used today, even though human service employees may have better skills to deliver these services when authentic emotions are important.

Companies, which have introduced service robots for the delivery of personal services (e.g., hairdresser, yoga teacher, or shopping assistants), should respect customers' different interaction preferences. Based on our analysis, we found two types of customers. Type 1 customers belong to the group that clearly prefers human interaction and is reluctant towards interacting with service robots. Type 2 customers like the idea of avoiding personal interactions in routine service settings and are happy to give orders or push a touchscreen to receive their service. In order to maintain positive service quality perceptions, managers should try to satisfy both customer segments by offering human and artificial alternatives and let them choose according to their preferences. Interestingly, service robots are already able to create a social presence with customers, so customers have the feeling somebody is taking care of them, even it is a robot (van Doorn et al. 2017).

Companies can also offer their services as a two-tier model. Service robots will take over the initial contact, and for issues that require deeper communication skills or psychological comfort, the service employee can take care of the situation. This approach seems suitable for complaint handling or service recovery situations that require experiential and contextual interactions as well as individualized treatment. In general, it is advisable not to leave the customer entirely alone with robots, but to keep "real" people still available as a backup for troubleshooting and intervention in emergency situations.

Time to Team Up! In the fourth quadrant, both cognitive/analytical and social/emotional skills demanded by a task are high. Examples include counseling, nursing, education, and medical services. In the future, these services are likely to be delivered by hybrid teams (human service employee and service robot) to increase the outcome quality and in general to provide more accurate services. The newly formed teams provide innovative (business) opportunities and are proof that service robots are not only designed to replace or substitute human employees but support joint-decision making (Jarrahi 2018). In these hybrid teams, task responsibilities are distributed between service robots that process information and service employees who enrich the interaction with their social and emotional skills. Currently, there are already some examples of how hybrid human-robot teams can work together at the frontline of services. In the medical context, machines can carry out tasks that were previously performed by employees (e.g., skin cancer detection; Esteva et al. 2017) and human doctors can take care of the patient and discuss treatment options. As this example shows, robots do not necessarily replace human resources, but tasks and responsibilities are rather redefined and reassigned within the organization, so it is a matter of redistribution rather than substitution.

5 Concluding Remarks and Implications

Connecting back to the movie theme in our introduction, *Hollywood keeps leading the way* and recent films have even much more nuanced and sophisticated scripts. Movies such as 'Ex Machina' (2015), 'Westworld' (2016) or 'Zoe' (2018) emphasize the challenges of co-existence between humans and robots. The lines between humans and machines get blurred, and humans and robots become increasingly indistinguishable. Westworld's "dark odyssey follows the dawn of artificial consciousness and the evolution of sin" (HBO 2016). Westworld is a theme park where human guests can explore the Wild West together with android hosts who are programmed to fulfill the guests' every wish. The hosts, who are virtually indistinguishable from humans, follow a predefined set of intertwining stories but have the ability to adapt to these stories based on their interactions with human guests. In the movie, all of the robots' memories of interactions are erased, but some androids are suddenly able to keep memories and gradually start to grow emotions and their own consciousness. These human sensations and the resulting desire for independence lead to a battle of powers and rebellions against the overwhelming supremacy and control of humans. Hollywood is – like in most cases – far ahead of what is happening right now in reality. We are not at this point yet or will not be any time soon. Service robots do not have a mind, a consciousness or an agency and are unaware of their own existence. They operate on the algorithm that has been programmed by an engineer and follow a script instead of their own needs and emotions. But perhaps in the next decades this might also change, and firms will need to exercise corporate digital responsibility to ensure that these new technologies protect the interests of their human customers (Lobschat et al. 2020). To conclude this article, we summarize the major implications of service robots for the field of service management and marketing:

Implication #1: The Service Industry is at an Inflection Point

The service sector is at an inflection point concerning *productivity gains and service industrialization* similar to the industrial revolution in manufacturing that started in the 18th century (Wirtz/Zeithaml 2018). For companies, this disruption and the constantly evolving technology creates growth opportunities that open doors for new service offerings and the reconfiguration of business models. The rapid growth of platform business models is one example of AI-powered scalable services that will dramatically change many service markets (Wirtz et al. 2019), often in combination with new technologies that are largely AI and data-driven (e.g., integrating data from wearable technologies; Paluch/Tuzovic 2019). As such, traditional service companies will need to use AI infusion to revive their value propositions, customer service operations, image, brands as well as corresponding marketing and positioning to remain viable and stay competitive in the long-term.

Implication #2: Reconstruction of the Organizational Frontline

When companies introduce service robots, their frontline service organization will inevitably change and *must be dramatically reorganized*. Service employees can be assigned to new service tasks and therefore will need to acquire new skills ranging from basic programming

to technical troubleshooting. This means for the future, that skills and competencies of human service representatives might need to change and the job market requirements would be affected by this shift. Companies themselves must be ready for change, so the AI-spirit can cut across all levels of the service organization.

Implication #3: Upfront Risks for Companies

The implementation of service robots and the reorganization of the organizational frontline is risky and involves high upfront investments. These investments include acquisition costs of robots and AI, recruitment of IT-specialists and programmers, and the building of virtual networks as well as maintenance of the systems. Some of these investments may have short pay-back periods (e.g., chat bots payback time is typically below 12 months), but others can take a while until costs are recouped through productivity gains and service improvement-driven increases in share-of-wallet, up-sales, cross-sales, and new customer acquisitions. Therefore, service robots should be regarded as *long-term investments.*

Implication #4: Human-Robot Collaboration

We do not think that robots will completely substitute human service employees now nor in the future. In fact, we strongly disapprove this assumption for the service industry. As stated above, humans might be substituted by robots for some standardized tasks (e.g. routine tasks), but we do not want to generalize that to all kinds of service contexts. For the future, we predict that hybrid human-robot teams and collaborations will be the preferred service delivery mode for many services. These hybrid teams will be able to realize productivity and service quality gains by *combing the advantages of AI and human service representatives.*

Implication #5: An Opportunity for Excellent Customer Service

Service robots are not the answer to everything but might be a good way to increase service quality. The "unlimited" knowledge and immediate access to customer profiles are an undeniable advantage that helps to customize service offerings even more. Customers receive individualized service and product recommendations based on their past purchase behavior and might save valuable time when interacting with service robots. Another beneficial aspect is the reduction of waiting time for customers when they can immediately approach a service robot, especially in the case of virtual robots such as chat bots and holograph-based robots. When issues get more complex, require individual attention or recovery service, employees can join the encounter and support the problem-solving process with their emotional and social skills. We expect that these *new ways of interaction will contribute to a better overall service experience.*

Implication #6: Service Robots and Customer Relationship Building

We still believe that human service employees are primarily responsible for building trustful relationships with customers. Their empathic and benevolent behavior as well as genuine emotions are the underlying foundations for trust and cannot be copied by robots at the

moment. Again, service robots can assist employees with information and customized recommendation based on the customer profiles that they access during the interaction. As soon as service robots recognize customers using their cameras, microphones, and sensors in combination with AI-powered biometrics, they can retrieve customer profiles, address them with their name and help them with their request.

Taken together, these implications suggest that this *service robot and AI-powered service revolution* may indeed offer the potential for a brave new world as was advocated by Wirtz et al. (2018).

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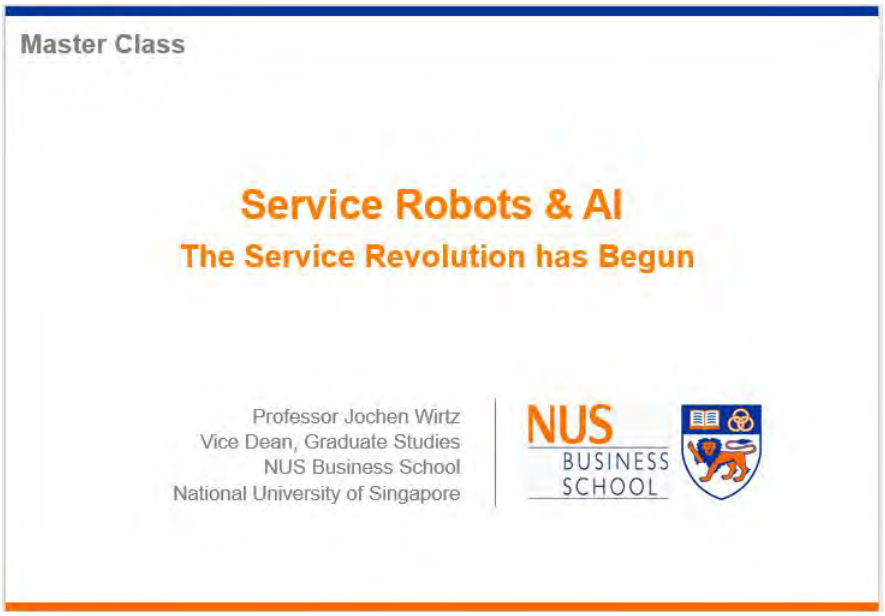

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