Multi-functional job roles to support operations in a multi-faceted Jewel enabled by AI and digital transformation

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- Thomas H. Davenport and Steven M Miller, *Working With AI: Real Stories of Human-Machine Collaboration*, September 2022, MIT Press, chapter on "Certis: AI Support for the Multifaceted Security Guard at Jewel Changi Airport." https://mitpress.mit.edu/9780262047241/working-with-ai/

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In this story, we highlight the way in which the use of AI enabled support systems, together with work process digital transformation and innovative approaches to job redesign, have combined to dramatically change the nature of the work of the front-line service staff who protect and support the facility and visitors at the world's most iconic airport mall and lifestyle destination.

The New Jewel of Changi Airport

Jewel Changi Airport is shopping mall, visitor attraction, nature environment and airport check-in facility all in one, located on the premises of Singapore's Changi Airport. It opened to the public in April 2019 and was built at the cost of US$1.25 billion on airport land that was formerly used as an ordinary open-air parking lot. The facility has over 1.4 million square feet of space spread over 5 above ground stories for consumer and lifestyle activities, and 7 below ground stories for parking and facilities infrastructure.

Jewel has an iconic design inside and out. The entire facility is encased in a glass dome that actually resembles the face of a multi-faced gem. The indoor nature-themed environment includes the world's largest indoor waterfall, the 40-foot-high Rain Vortex, 120 species of plants including 2000 trees and 100,000 shrubs, canopies in the form of walkways and bridges, sky nets for walking and bouncing, and mazes. This all provides the ambiance for the nearly 300 retail outlets, other visitor facilities and attractions, and airport check in facilities that supplement those located in the terminals.

After its opening, Jewel Changi so captivated the attention of international air travelers passing through Singapore's Changi Airport, as well as the local Singapore population and local tourists, that it received over 50 million visitors within its first six months of operation, an average of nearly 300,000 visitors a day over that period, and this high level of visitation continued through the end of January 2020.

Of course, with the spread of the Covid pandemic, visitor traffic to Jewel started to reduce in February, and dramatically reduced from March through mid-June, mirroring the reductions in Changi Airport passenger traffic, and reflecting the Singapore ten-week national lockdown overlapping with most of this period. Visitor traffic to Jewel is now gradually increasing in step with Changi airport traffic trends, though it will take a while for visitor rates to return to the high levels achieved at the end of 2019 and the very beginning of 2020.

Certis Group, the Outsourcing Partner for Security and Related Services

Certis Group is the private sector company that is responsible for ensuring the physical security, visitor support and safety, and facility support for the new Jewel facility at Changi Airport. Certis provides the front-line workers -- security guards, guest concierge and service officers, and facilities maintenance staff -- who deliver these services.

The origins of Certis go back to 1958, when the Singapore Police Force created a special Guard & Escort Unit. In 1972, this unit became a separate organizational entity within the Singapore government, a statutory board under the Ministry of Home Affairs, named the Commercial and Industrial Security Organization (CISCO). In 2005, CISCO was privatized into CISCO Security Private Limited to enable them to compete for commercial security and related facilities support contracts domestically as well as internationally. The 100% owner of CERTIS was and continues to be Temasek Holdings, a commercial investment company that is 100% owned by the Singapore government, that functions as a private sector entity to commercially manage investments and assets previously held by the Singapore Government.

 As CISCO began to expand their facilities security and related facilities operations support services overseas after the 2005 privatization, they kept encountering customer confusion with the globally prominent computer and data networking company with the same name. To remedy this, the company eventually changed its name to Certis Group, though they retained

their CISCO name within Singapore until 2018, as it was such a well identified local brand for security services.

Generations of Singaporeans are familiar with the ubiquitous presence of CISCO guards (now Certis guards) as the security officers stationed at the front desks of office buildings and other industrial, commercial and governmental facilities, and as the people who patrol the premises of shopping malls, markets, Changi Airport terminals, and nearly any type of large facility requiring security patrol. Certis had expanded into other areas of "Ops-Tech" outsourcing solutions over the years, some of which were more technology based, though to the general public, the security officer was still the iconic image of the company.

Recollections from former years of Certis/CISCO security guards were anything but high tech. This type of work had always been manual and labor intensive. Security service contracts were specified in terms of the number of "bodies" stationed on site, rather than in terms of key performance indicators to be achieved. Support technology mainly consisted of using walkie-talkies and watching CCTV monitors. Many aspects of providing physical premise security and related visitor support services were the epitome of lower wage, lower skilled "body-shop" work, with a large proportion of it done by older workers. The conventional way of doing this type of work did not match up to the shine, capability and efficiency required to meet the needs of the new Jewel at Changi Airport.

A Digitally Transformed Approach to Delivering Security and Related Services

When Jewel opened its doors to the public in April 2019, CERTIS simultaneously introduced an entirely new, technology-enabled approach to its service delivery called "Security+." The six key elements of this new approach included:

i)   a technology intensive approach to the monitoring and surveillance of the entire Jewel facility, including over 700 CCTVs and 5,000 additional sensors;

ii)   a centralized, on-site Smart Operations Centre where all of the monitoring and surveillance data is consolidated, integrated, analyzed and visualized, and assessed by operators;

iii)   a software platform called MOZART that handles the consolidation and integration of all incoming information sources, that includes AI capabilities for analyzing video and other sensor inputs, that identifies situations requiring operator follow up, and that serves as the key support and orchestration system for Smart Operations Centre staff;

iv)   a mobile phone application called ARGUS that is tightly integrated with the MOZART platform, that enables security guards and other front-line staff to communicate with the Smart Operations Centre staff as well as with one another;

v)   the addition of service robots to the front-line patrolling workforce to handle specialized monitoring tasks and

vi)   a new approach to job design where the CERTIS front-line security guards, guest service officers, and facilities staff are all crossed trained to support one another.

CERTIS had been piloting and deploying some of these elements of Security+ in recent years, including ongoing efforts with the regular airport terminals at Changi Airport. However, the launch of Jewel was the first time CERTIS had brought all six of these elements together into one fully integrated and unified service deliver approach.

The New World of Work for the Security Guard Manager, Jun Yuong Pang

Jun Yuong Pang (who goes by his family name of Pang), is 29 years old, and has been a security guard for Certis for the past ten years. He spent the first nine years of his work as a Security Guard and supervisor in the two newer Changi Airport terminals, Terminals 3 and 4, doing access control. In Terminal 3, he screened Changi Airport Staff who worked in that terminal as they entered the staff entrance. In Terminal 4, he was stationed at the immigration checkpoint area for outbound passengers and was responsible for the final screening area after they cleared the immigration officers and before they entered the controlled area of the airport terminal. It was typical work of a security guard, with the same routine day after day, except for occasional incidents to deal with, and with minimal need for technology support. And with an overabundance of time consuming, manual work required for submitting incident reports and doing other required administration related to his supervisory responsibilities.

In May 2019, Certis moved Pang to Jewel to supervise and manage the security team which consisted of 17 other security guards and one robot named Peter (an acronym for Patrol and Traffic Enforcement Robot). Everything about Pang's work changed, even though he was still working as a security guard and supervising other security guards.

Now, Pang is responsible for security across a very large, multi-purpose facility. He and his team members are always on the move, patrolling. Because of the Smart Operations Centre, the MOZART platform and its embedded AI capabilities, the ARGUS mobile app, and the cross-functional approach to job roles, Pang is no longer functioning as an individual security guard who also supervises other individual security guards. He and his security team are now an integral part of a well-coordinated network of people and intelligent support systems who are linked through digital means, and all supporting one another through two-way interaction. This has substantially changed the way a Pang and his security guard team members spend their time each day.

The MOZART platform includes functionality to generate patrol schedules for each security officer on each day. This includes some degree of randomization to make patrol routes less predictable. The proposed daily schedules also incorporate information available to MOZART on special events scheduled to occur, or other special circumstances. Because of this intelligent systems support, at the start of each day, Pang does not need to go through the time-consuming tasks of working out patrol routes for each of his security guards, preparing worksheets to hand to each of them, and briefing them on their daily schedule. Rather, he uses ARGUS to review the daily patrol schedules for each team member generated by MOZART. He

makes whatever patrol route adjustments he thinks are necessary, based on information he is aware of that goes beyond what MOZART has access to, and via ARGUS, he automatically distributes the patrol route to each team member, as well as to the Smart Operations Centre. It is no longer necessary for the security guard team to show up early before the official start of their patrol work just to get their route assignments.

As security guards patrol, they encounter incidents, and every incident requires an incident report to be filed. This has been a problem for the security industry for decades. For a security guard, and especially one with supervisory responsibilities, the bane of one's work life existence were the submission of incident reports and follow-on efforts to verify and make use of these reports. It was tedious to write up these reports, and security guards did not like to do it. Many older officers had challenges doing so. Often, details related to exact timing of events were inaccurately stated, and details on location were often ambiguous, as were the description of the actual incident itself. It was common practice for the security guard supervisor to have to re-interview the guard who submitted a report to clarify details and re-write the report.

The deployment of AGRUS and its integration with MOZART completely transformed the process of submitting an incident report, as well as all post-submission processes related to archiving and subsequently accessing and using the information. Incident report submission templates in ARGUS make it possible for the security officer to click a few buttons to choose appropriate categories, add pictures as documentation, and add a few descriptive comments. Press send, and that's it. Time stamp information and location information is automatically specified. All information capture related to the incident is digitized from the outset. The report immediately flows to the Smart Operations Centre and into MOZART. The SOC staff assess the input from that one incident report, interpret it in the context of all of the other centralized information available within the SOC available through MOZART, and determine the follow-on response.

The incident report submission process has been so dramatically simplified that it is now practically possible, and common practice, for Pang and his fellow security guards to do a more thorough job on security related incident reporting, even for smaller items, and additionally to support incident reporting for facilities management, as well as for guest services. This is where the cross training comes in.

If Pang or one of his security guard staff observe facilities issues such as water leakage, or a landscape issue or something else that needs to be reported and responded to, they will submit an incident report on this, as it is so easy and fast to do so. The security staff are also cross-training on some very basic aspects of facilities support. Pang explains "If our security officers happens to be the first to notice that an escalator, or a sliding glass door, or a ticketing kiosk is not working, the officer is trained to reset it to see if that restores operations." Similarly, if a visitor wants to convey feedback or a complaint to Jewel, and they happen to communicate this to a security guard rather than a guest services officer, the security guard can submit the feedback as an incident report, with the appropriate categorization as customer feedback.

The guest services officers and the facilities staff also use the same ARGUS mobile phone application for their incident reporting. Due to the dramatic simplification and times savings in this all-digital approach to incident reporting, staff in these two other functions have also expanded their scope of incident reporting to cross-support the other functions. Zell Chow, Pang's counterpart who manages all of the guest services staff at Jewel, explains this in the following way: "We train our customer service people to function in hybrid role that also includes aspects of security and facilities support. They're not just concierge people sitting behind a service counter. They also rove around the facility as part of their customer service work. When they rove to interact with visitors, they are trained to look for different things. They provide more eyes on the ground, and this helps us with security. It also helps us with facilities support, as they also spot things that need landscape maintenance or facilities follow up. We could not perform in this multi-functional way without our supporting technology."

The Smart Operations Centre (SOC) as Mission Control

The Smart Operations Centre staff is constantly monitoring all incoming incident reports from security guards, as well as from the guest services officers and facilities maintenance staff to determine when and how front-line staff on the ground need to respond, depending on the nature of the incident reported.

They are also monitoring the alerts that are automatically generated by the Mozart platform as the system uses its embedded AI capabilities to constantly monitor and analyze the stream of incoming information. Aaron Soo, head of the Smart Operations Centre at Jewel, and the manager overseeing both Pang and Zell, explains SOC monitoring in this way. "There are also thousands of information sources we monitor including activity levels at specific locations, human traffic counts, crowd build ups, the location of our own Certis staff, temperature and humidity sensors, spots where the temperature has increased, all incident and situation reports from ground staff, and digitized customer feedback from our feedback stations in bathrooms and other Jewel locations."

The technology systems deployed by Certis at Jewel are constantly monitoring the entire facility to support important operational objectives including the following:

Visitor safety: Detection of potential dangerous visitor behavior that may lead to accidents, e.g. visitors trying to cross the barriers leading to the Rain Vortex giant indoor waterfall, or visitors behaving inappropriately on canopy walkways or sky bridges.

Lost & Found: Searching for lost people such as a child separated from their parents, or an unescorted elderly visitor who seems disoriented and is loitering for an extended period.

Security & Surveillance: Detection of situations such as people entering restricted areas, unattended bags, people fighting, unusual or suspicious loitering, atypical crowd gatherings.

Workplace safety: Detection of workers without proper personal protection equipment, or of barriers not in place around heavy lifting equipment.

Traffic safety: Detection of cars that park by the curbside in front of Jewel's main entrance and drop-off point that do not respond to instructions from Peter the traffic patrol and enforcement robot to move along.

Inclusive Workplace: Detection of members of public requiring assistance, e.g., visitors who are physically challenged and who would benefit from the availability of a wheelchair, and detection of smoking in prohibited public areas.

By assessing the alerts automatically generated by the MOZART Platform, and the incident reports and other incoming communications submitted by ground staff via ARGUS, the SOC manager and his operators determine when it is necessary to mobilize their front-line staff to follow up on an incident.

The SOC team always knows where all of the security guards, guest service officers and facilities staff are physically located, through a combination of location tracking through ARGUS and the other sensor information they have available. For some types of incidents, they just need the nearest ground staff person to take a look, and because of the multi-functional job role approach, they have the flexibility to identify and redeploy whoever is closest, whichever functional team that person is from. Other types of incidents require a specific type of person to follow up, such as a security guard, and they can locate and redeploy the nearest guard.

Through ARGUS, Pang, as the security guard manager, has visibility to these communications, as does his counterpart Zell, the guest services staff manger. The two of them coordinate closely with the SOC and with each other to plan how manpower on the ground should be deployed to respond to a particular incident. The SOC team will send targeted broadcast through ARGUS, either to a particular person, to an entire team, or to all ground staff, depending on the situation, as part of orchestrating the response. In parallel, the team managers, who are also part of the ground staff, keep closely connected with their respective team members distributed across the large facility.

Zell explains what it is like to manage one of the front-line functional teams at Jewel with the support of the Smart Operations Centre. "The Smart Operation Center (SOC) is like having eyes that can see the overview of everything across Jewel, and like having a centralized brain made up of both human and machine intelligence that can strategize how to move people around like a master chess player can strategize on how to move his pieces in response to what situation he may encounter during his chess game. The other ground managers (including Pang) and I coordinate with the SOC staff to decide how to move our ground staff people in response to the nature of the situation, based on situation awareness across the entire Jewel facility. Under the orchestration of the SOC staff, we decide who to move, and where and when to move them. This type of decision making in response to an evolving incident is like playing a chess game, which is pretty interesting."

What Pang the Security Guard Manager Likes About His New World of Work

Pang likes the fact that he has the support of the Smart Operations Centre, and that he and his team get to use all of this new technology. He comments, "Using ARGUS, I can easily access all of the incidents reported by my security team members. I can also easily see the details associated with each incident including what, when and where. Our incident reports are more accurate. I do not have to go back to my security officers after every incident, clarify all the details of what happened, and create another version of the incident report. This saves me a lot of time."

He especially likes that fact that he always knows where his security officers are, where they have been, and where they are heading. He notes, "It is really important to me to be able to check on my team in this way." He notes that with ARGUS, it is so much easier for him to communicate with all members of his security team, as well as with other Certis staff teams at the Jewel facility. The fact that he and his security team work more closely with the guest services team and the facilities team "makes it feel like we are a closer family." Because of the multi-functional job roles, he says he likes the job variety and challenge that goes along with this. He comments, "I like that it is not always the same thing day after day after day."

Another aspect of his job that he really likes is the elimination of "complaints from my team members about having to do curb side traffic patrol, thanks to Peter, the Patrol and Traffic Enforcement Robot." Pang further explains, "As this is Singapore, it is always hot outside. Even more so at this particular location because this is an area where cars pull up and stop. Our security officers do not like to be assigned to curb side street patrol, as it is quite uncomfortable compared to indoor work. Now that Peter the robot can patrol this curb side for cars that remain parked for too long, we do not need to station a person full time at this location. Peter the robot notifies us when a car is staying put for too long, and as and when needed, we dispatch an officer to attend to the situation." Pang emphasizes, "Peter the robot makes our life better by relieving us from the need to spend extended periods of time outdoors doing patrolling."

Challenges for Security Guard and Guest Service Ground Staff As They Transitioned To This New Work Environment

Transitioning to this new work environment at Jewel, with all of the new support technology, as well as with the new approach multi-functional approach of having ground staff in one function back up those in the other functions, has not been without its challenges.

Pang's manager, Aaron, noted that for the Certis security staff with prior airport security officer experience, a lot of changes had to do with learning how to do high levels of visitor

engagement, as this aspect was not emphasized to the same extent in their previous job in the airport terminal as a security guard. Given the nature of the Jewel facility, even the security officers have to know how to engage well with guest.

Pang reflected on the challenges of getting his security guard team members comfortable with using the new support technology. "It has been a big effort to get our older security officers, especially those 60 and older, to use ARGUS, and to do their job in new ways. My security team members, especially my older members, have shared with me that this has been a very challenging experience, but a good experience. It has taken time for them to learn and adjust. Fortunately, they have all managed to do so."

Pang noted that he had to become a fast learner, faster than his security guard team members, so he could guide them. He commented on how this process was bootstrapped. "My managers guided and coached me. Fortunately, my supervising managers such as Aaron and my team manager counterparts like Zell provided me and the security team with the guidance on how to do this. They patiently showed us how to use the technology. With this support, I was able to guide and coach my team members."

Zell added additional background on the transitional issues of getting the front-line employees in customer service and in security on board with the new technology. "We put a lot of emphasis on making our support tools for our front-line support staff very easy to use, with special emphasis on ease of use for older workers. We have made it much simpler to create and submit an incident report, as that is an important part of their job. We have redesigned our training materials to incorporate more pictures and videos, and to reduce the use of long sentences. We have made training content and sessions more fun. "

Zell compared his current Certis work at Jewel to his prior work Certis work in the Changi airport terminals. "Compared to my prior assignments with Certis years back, I now spend more time in my current management role at Jewel working with our ground staff, and especially our older workers. I work with them to get them to understand why we are moving forward with technology, why we are equipping everyone with ARGUS which is the key support technology they use in their work every day, and how they should make use of it."

Both Zell and Pang pointed out that there are counterbalancing forces, as in, ways in which the new technology is both harder to use and easier to use for their older workers. Indeed, for some of their older workers, it is a challenge for them to adapt to using the new support technology, and it takes them a longer while to do so compared to the younger employees. Then there is the other side of this. Because of how the new support technology has simplified or eliminated many of our tedious administrative and reporting processes, it gives their older employees a better chance to enter the CERTIS workforce, or to remain on as an active, contributing employee. For example, they no longer have to worry about typing long sentences in their incident reports. In fact, they don't even have to worry about using a pen to write anymore. While ARGUS requires the older worker to learn how to use a new tool to work in new ways, it also makes the work more accessible to them and less tedious. For those older

workers with a positive attitude who are willing to learning new things and work in new ways, both of these managers noted that the new support technology can be a big advantage for them and can actually extend their duration for staying employed.

Pang, as well as Aaron and Zell, highlighted that the CERTIS digital transformation effort and technology deployments at Jewel created a large need for ongoing learning and training. At the same time, because of the resulting efficiency and productivity improvements, and the substantial time savings this created for each of them, all three of them were able to reinvest their saved time into working with their team members to make these adjustments.

Zell summarized this situation in the following way. "The technology saves us a lot of time, and we reinvest this time back into the training and welfare of our people who need more guidance and support as a result of working with the new technology. This cycle takes us to higher levels of service delivery and productivity. We never could have progressed in this way in our prior days before our digital transformation efforts."

The Future for AI and Humans at CERTIS

Given his perspective as head of the Smart Operations Centre at Jewel, and direct supervisor of Pang the security team manager and Zell the customer services team manager, Aaron shared his thoughts on how he anticipates the work setting at Jewel and Certis will evolve. "In the years to come, as the capabilities of our systems continue to improve, I anticipate that we will be able to automate more of our operations tasks in our SOC as well as on the ground. I anticipate we will steadily realize even higher levels of productivity and would be able to further reduce certain types of manpower."

At the same time, he is convinced that humans will continue to play essential and irreplaceable roles in the Smart Operations Centre as well as in the ground staff teams. He explains," Overall, there are just too many novel or non-standard situations that we encounter in the SOC when we monitor and assess the alerts automatically generated by MOZART and the incident reports from the ground staff. That is why it is essential to have people reviewing the alerts and reports, deciding what actions to take, and overseeing the response." He emphasizes that "Human judgement is especially important in dealing with unusual incidents and emergencies."

Aaron notes that, "Even with all of our automated sensing, intelligent support technology and digital platforms, our staff on the ground are still a very important part of our ability to sense what is happening across the facility. They are also the key way that we follow up on alarms and respond to incidents." He elaborates, "no matter how much we might be able to eventually improve our technology and systems, and improve productivity, many aspects of security in complex real-world settings like Jewel will still have to be done by people on the ground. Even more so for customer services and experience management. I anticipate that in the future,

many aspects of security and guest services will still require humans to relate to other humans on the front-line, and to respond to unusual situations"

Aaron emphasized the importance of the role that he, his SOC staff members, and his ground staff team managers like Pang and Zell play in coordination, communication and orchestration. "We need to handle many levels of communication as incidents are occurring", he says, and "all of this follow-on action, coordination and communication must be executed and orchestrated. We need capable people - the human factor - to do this."

He summarizes his current outlook for combining digital support, AI, and people as follows. "Our intelligent support systems such as MOZART can help us with facts, alerts, and with various other types of supporting information. ARGUS can help us in capturing incident information from our support staff on the ground, and in broadcasting information to our staff throughout this large Jewel facility. But our intelligent support systems are not capable of knowing how to summarize a dynamic, bespoke, multifaceted situation in such a way that the right type of situation update, impact assessment, and action plan can be appropriately communicated to each different type of important stakeholder who needs to be briefed in real time. Also, as incidents are occurring, one has to know the appropriate way to respond to the barrage of questions from senior management and external authorities, and how to provide the situationally relevant context and assurances to the different stakeholders that we need to keep informed."

He concludes, "My SOC team and I, as well as our ground staff team managers, do very complex "man-in-the-middle" coordination and communication across the ground staff at Jewel, our senior management at CERTIS, the senior management of the Jewel mall owners (Changi Airport and CapitaLand Malls), and also with other external parties including the ambulance teams, medical facilities, and the police. Our technology, as advanced as it is for this type of commercial application, just does not have the capability to do all of this type of coordination and communication, especially for unusual situations. Not yet at least, and not for any foreseeable future. Our technology supports us in a big way. It helps with taking care of most of the mundane tasks that are important parts of our monitoring and operations work. But our technology has a long way to go before it has the capabilities to handle many of the important aspects of what our people need to do in unusual situations and emergency incidents."

It looks like humans and the human-machine partnership is here to stay in this type of work setting, even as AI capabilities and applications continue their rapid and remarkable advance.

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