SMI-UTU Webinar: Digital Port Ecosystem
Answers to Questions posted during the Panel Discussion

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No	Question	Answer(s)
1	We hear about many aspects in Jurong Port's journey in digitalisation. There are many objectives and also many potential benefits. Looking from a multipurpose port perspective, what are the key objectives of digitalisation and what is the most important objective you want to achieve?	**[Tan Wee Meng]** From the port perspective, there are two key considerations on the way we plan the digitalisation efforts. Firstly, is environmental sustainability, because this is quite a massive effort in order to ensure that everybody is able to assist to bring down the carbon footprint. As it is now, the individual companies may not be able to do that because they may not have that platform available for them to optimise their trip. So, as I mentioned in my presentation, the most critical node has to take the initiative, because from the port perspective, with respect to the industry, we will be perceived more as a neutral party to synchronise with everybody, in terms of how to reduce the truck trips and optimising the routes. Second is from a digitalisation perspective. Just as Dr Marikka had presented earlier on, there are significant advancements from container port perspective, but for general cargo port, many of which are still lagging quite far behind. We started almost from ground zero, building the terminal operating system as we explore the options and then decided to do it on our own. These two aspects are important, because the more we digitalise, the easier for us to mine the data using the more advanced technology. What I did not have the time to present is our intention to move towards using AI and machine learning to try to identify areas whereby we can optimise the logistic flow better.
2	Looking at digitalisation from the cargo owner perspective, what expectations does the industry have on smart port/intelligent port development? Can you elaborate a little bit more on how you as a customer sees the development, whether in general, or from the metals industry perspective?	**[Niko Korte]** We always have a generic requirement, that is efficiency, obviously, for the analog world and for the digital world. Let me zoom in a little bit on the sort of the expectation for the digital part. I would like to discuss on visibility. We are in a steel business; we are in multi-modal transportation. So, we're not only dealing with the containers, we have trucks and trains and a combination of those. For us, it's very important that our partners in the port and throughout the value chain have the connectivity possibility. We will actually start requiring from

our carriers, from Q3 onwards this year, connection to a visibility platform that we're just building. What is most important for us is to receive that status information where the material is. It's important to know it on the material level, not necessarily always on the vessel level or our train/car level, because that doesn't mean anything to our customers. So that is very important. We also in future require ETA information. I was delighted to find out in Sami's presentation, a testimony of how complex that really is, and we have no false illusions on how difficult is that. We have to start getting that data already today.

I would like to also bring another perspective on visibility, which is visibility on the CO_2 emissions of the chain. We will start shipment of fossil-free steel in 2026. We want to expand that of course throughout the chain so we can provide the customer with the fully CO_2-free delivery. We are going to start to collect that data today about what is the real Co2 footprint. So, it's not only about the material whereabouts where we need the visibility, but we need also the visibility into the CO_2 footprint. We have plenty of different business benefits from this, the most important is that customer experience is improved. If I buy a pair of shoes online and the delivery is delayed couple of weeks, it doesn't really matter as I can just use my old shoes. But if our customer's car manufacturing plant is delayed with the delivery, we may actually stop the production in the car plant and no one wants that to happen. So, situational awareness is very important so that we can react as early as possible in any deviations in the value chain.

3	Next question I would like to address it to Marikka as a member of the academic community. How do all these presentations and also comments so far relate to the wider concept of Industry 4.0? I think from one end in the industrial context, we are seeing that the Industry 4.0 seems to be very widely spread and a clear concept. But you mentioned Port 4.0 as well. Do you see all port stakeholders share similar, or very different interpretations when it comes to smart, intelligent, or digital port concepts? How do you see this from the academic perspective?	**[Dr Marikka Heikkila]** Actually, what you raised is exactly to the point. When we were interviewing the ports, the naming was very different. Not many of the ports were using the Port 4.0 term, instead they were using intelligent port, or smart port, or even dream port. But in the end, they are all about the same thing. So yes, the term and concept are not very clear for the practitioner.
4	Matthias, about the interconnectivity in the port ecosystem, and especially the 5G technology which you presented, do you see 5G as a means to extend digital connectivity between different port stakeholders and therefore foster the digital ecosystem development? Or is it something that currently at this stage is most applicable within the boundaries of single organisation? For example, terminal operators?	**[Matthias Jablonowski]** I think there's currently a lot of things ongoing. Of course, my presentation was mainly focused on the port terminal operators. The reason why I focused today mainly on the operators is just because I think we see a little bit more implementation there. So that's where just because there is a business case, there is a need really to become more efficient and the immediate impact on the operations of the business. That's the area where we really see not only pilots, testing, but commercial deployments today. Many of these are actually not public. But we see now more and more container terminals really adopting this technology.

This of course does not mean that the wider port ecosystem is not looking into this. I think there are very good examples. We as Nokia, for example have worked with the Hamburg Port Authority. Some years ago, we have worked with the Port of Antwerp. The port authorities' main ambition was to bring the ecosystem together. Of course, the Port Authority itself may have their own use cases for their own operations, but also bringing the ecosystem together and making the port as a location more attractive to shipping lines, and private companies operating in the port. One of the very small port, but probably an advanced Port Authority in terms of |

		thinking is the Port of Oulu in Finland, where this has been done for example. They have an LTE network, but it will evolve into a 5G deployment sometime. But there we have the Port Authority that has invested in this technology for various use cases. We speak about digital twin, but we also speak about offering connectivity to the various companies operating in the port limits. So definitely, I would say something very interesting that's emerging at the moment. Just because it's a little bit more complex environment, as we have different stakeholders coming together that need to collaborate and that need to get the value out of such a deployment. So probably still some more work to be done, or probably less defined yet, I would say, what we see in the container terminals.
5	Thanks for sharing this interesting info. Regarding the 5G wireless solution, may I ask Mr Matthias (Nokia) what are the key differences between using a private 5G and using a telco-provided commercial 5G infrastructure? If the private 5G is selected, what can be the potential challenges in the deployment process? Thanks.	**[Matthias Jablonowski]** A very good question. At the end, from a technology point of view, both networks would use exactly the same technology. So private 5G is not a different technology than the public 5G that the telecommunication companies use. The difference is in the way it's being deployed. Public 5G network is designed to cover a nation, it's designed to serve consumers and enterprises. It's really designed for the masses, and it's about wide coverage. A private network is more or less the same, but we could say perhaps downscaled to cover only a compass and a compass could be a warehouse, it could be a terminal, where everything is on premise. At the end, what we typically say to our customers when these questions come up, is that it starts with the use case. So, it really depends on what are you trying to achieve. Probably the more critical use cases become, the more customers would prefer private networks, just because that means everything is in their control. For example, if you do remote control of straddle carriers of RTGs, there are certain latency requirements, throughput requirements, and we need to set priorities. These are all things which probably we can't do in a public network just because the network is not only for me, not only for the customer, but it's shared with many others. There is also data privacy. When you have a private network, everything stays on premise, everything stays inside the container terminal. If it's more about a wide area, for

| | | example rails and trucks, perhaps not in Singapore, which are approaching the port and you also want to connect them, perhaps then it's more about the public.

Of course, there is even to make it more complicated, hybrid architectures where we combine private to 5G networks for the container terminals and then public networks, maybe more for the port authorities, maybe more for the logistic companies, the trucking companies, rail companies approaching the ports. |
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| 6 | Wee Meng, you mentioned earlier that ports are in very different development stage when it comes to digitalisation. If we take a broader picture here, and compare ports to other parts and actors in the end-to-end supply chain, do you see ports in general underperforming or outperforming in terms of digitalisation? If there are big differences, what do you think might be the reason? | **[Tan Wee Meng]** The way I look at the digitalisation aspect, a lot depends on the cargo type. Taking Jurong Port as an example, we have the integrated, common user cement terminal for Singapore. This terminal encompasses seven separate customers. One of them has a very elaborate digitalisation platform in place to track their vehicles, the cement truck moving in and out of the terminal, regardless of how we develop our platform. In this aspect, I will say that the customer is actually moving way ahead compared to the port. On the other aspect, such as the example which was brought up on the construction industry, from the port perspective, we are like a nexus, where we have multiple customers coming through us. On that basis when we develop the digitalisation effort, it is a more over encompassing approach whereby it's not just one customer, we have multiple customers coming through us. So therein lies the economies of scale, whereby I have enough data points to do better management and optimisation. I wouldn't say which one will outperform, as it is highly dependent on the needs. When we look at digitalisation, we are very mindful of the fact that we don't just digitalise for the sake of digitalising. Digitalisation is way beyond converting written materials into a soft copy. Digitalisation comes into play when you look at the huge amount of data we have in our possession, and think how we can optimise the data. So, I wouldn't say whether we are outperforming or underperforming. |

| 7 | There are a lot of discussion on how digital technologies will disrupt working life - the concrete jobs that will be available in the future. How do you see that work in ports will change and which tasks do you see will be mostly affected by implementing digital change? | **[Tan Wee Meng]** What we see significant is that we have in the past, stevedore workers who are manually involved in the movement of the cargo. Singapore, being a very small country, as we move towards overall digitalisation, the younger generation is not so keen to participate in all the manual labour activities. So, we are effectively forced by circumstances to reduce our reliance on human labour, and move towards mechanisation. In so doing, we have to train a different group of people, moving them from their manual involvement in the cargo movement into understanding system, understanding data, engineering, and so on. This will help ensure that when we operate the machine or maintain the machine, we have the relevant people for the role. There will be a drop in the aspect of the manual labour.

Our main focus is to upgrade the staff wherever they can and with their capacity to learn, to upgrade them into a more engineering based and data-based type of role and responsibility. |
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| 8 | Interesting sharing on future scenarios for smart ports. Any insights on which of the 4 that Dr Marikka might recommend for Finland and Singapore respectively based on their specific characteristics? | **[Dr Marikka Heikkila]** These four scenarios will probably all realise in some parts of the world, so they are not excluding each other. I was thinking about the question on which model is being adopted by Singapore. We can see that the Port Authority in Singapore is very active in building the port ecosystem. It has a start-up ecosystem and doing a lot of work around there. But on the other hand, we can see for example, PSA has 60 terminals in 26 countries, it's integrated with Ocean Network Express liners, and also belong to a consortium, building a blockchain type of approach and competing with Maersk TradeLens. So, we can see the port ecosystem there being very strong, but on the other hand, the logistic chain alliances are also rising. |
| 9 | Which model is being adopted by Singapore? | **[Tan Wee Meng]** In fact, reference to the four scenarios which Dr Marikka's research has surfaced, the second scenario on port ecosystem is exactly what we are doing, it is almost spot on. The objective is also quite relevant because one of our key drivers is obviously sustainability. Also from a social aspect, like for example the construction industry aggregate movement, the RMC movement of the truck, we reduce on average about 600,000 truck trips on a per annum basis, just by |

		concentrating a lot of the activities within the port. So, we are definitely into the port ecosystem model. At the same time, for the steel ecosystem, we are also moving into the logistic chain alliances, partly because we believe that putting ourselves into the logistics value chain, we can give a fair number of resources to help the industry manage the excesses. For example, when moving cargoes from the stockpile area to the factory for fabrication, each customer will have their own fleet of truck. But if we are able to manage that on their behalf, by having all the stockpile concentrated within Jurong Port, we effectively can eliminate about one-third to two-third of the truck fleet, because we can do the mill-run on their behalf. There's no requirement for the customer to own the fleet of vehicles individually. This will contribute to significant savings on their part. In my view, the four scenarios that Dr Marikka's research showed earlier, we are quite clearly going into the ecosystem model, as well as the logistic chain alliance model.
10	Able to highlight specific areas which can't be implemented via 4G?	**[Matthias Jablonowski]** Projects are typically approached from a use case perspective. Often projects start by implementing 4G technology and will migrate to 5G over time once a new use case requires it. 4G and 5G are one technology family and migrating is possible. Anyway, most port / terminal automation use cases are addressable with 4G technology today in the experience of Nokia but there are some use cases that will benefit from 5G going forward. This is mainly relevant for remote control use cases that require highest video traffic and lowest latency connections.
11	Any comments on how private 5G may affect/influence interoperability across the value-chain (e.g. land transport, supply chain, etc.), be it IoT data exchange or standard protocols? How do you foresee firms' transition from current tech to 5G and any best practices to share (e.g. standards, security, etc.)?	**[Matthias Jablonowski]** Nokia sees introduction of 5G across the end-to-end supply chain. Private 5G networks are considered for port terminals; hybrid or public 5G architectures complement for hinterland connections. Most 5G projects are implemented in a step-by-step approach starting with one use case with more use cases being onboarded over time.

12	Great presentation from Mr Tan Wee Meng! It was interesting to learn your journey from zero to modern day. You mentioned that you had to build the terminal operating system from scratch. I am interested to know if you ended up finding commercial TOS aimed for multipurpose port OR perhaps decided to build it yourself? Asking this because, selection of fitting TOS for multipurpose ports are very difficult to find. Thank You.	**[Tan Wee Meng]** We evaluated 11 TOC which are commercially available, but found non to be suitable for our application.
13	Niko, having heard all the current issues, development opportunities in digitalisation, port ecosystem development and the different options, how do you see the current situation as a customer? What would be your key message as a customer to the supply chain in its current state?	**[Niko Korte]** I've liked a lot what I've heard. If we can bring what we've discussed here into practice, it will be amazing. I was happy to hear, especially from Mr Tan, the situation that is happening because this is something that we really need. We work with this type of hub setups in Europe already, and we find that very beneficial. We reduce the number of legs, so that's better for the visibility and best for our customer. If one would summarise this somehow, I think it's important that we share information, we share data and we try to create common standards for integration. We've been discussing about APIs here, but question is how do you describe the API? Do we have some standards, so that we don't stick to one set of terminology for ship, one for rail and one for trucks? It might not be SSAB who is technically requesting the data, but it might be a third-party connectivity partner who is also connecting the railroads and the trucks, which are part of the same chain. It's important that despite of the transportation mode and transfer, the number of transportation legs, we get connected in a way that we can share the data in all directions.