THIS BRIEFING PAPER INCLUDES KEY TAKE-AWAYS FROM TANK MEETING NR 44, THE FOURTH IN 2018. HOSTED BY SKF IN GOTHENBURG ON "REVOLUTIONIZING INDUSTRIAL MANUFACTURING BY AI."

Milen Kourtev and the team at SKF led the tank meeting on AI and World Class manufacturing, using Ideation & Hype Matrix as an innovation tool. The innovation workshop was curated by Christian Appelt at Ambient Society.



A world of reliable rotation

SKF has been a leading global technology provider since 1907.

The company's fundamental strength is the ability to continuously develop new technologies – and to then use them to create products and services that offer competitive advantages to our customers. Today the company's two value propositions are: Rotating equipment performance and Product. SKF strive to be the undisputed leader in the bearing business; working with World Class manufacturing.

During the tank meeting we had a chance to visit one of SKF's world class factories in Gothenburg where we learnt more about Industry 4.0 and saw what a factory with a minimal amount of operators looks like.

PURPOSE

The purpose of the workshop was to explore what questions are important to answer when improving manufacturing by AI. Looking at SKF that are at the beginning of the journey today – and what questions they might not have asked themselves.

The main challenge of the day was: where, and how, can AI be used to boost traditional manufacturing into world class?

INDUSTRIAL MANUFACTURING BY AI & INDUSTRY 4.0 - TRENDS AND PREDICTIONS

The day started off with an introduction to traditional manufacturing processes and technologies, and the current challenges therein. Lars Werner from SKF showed a video taking us through the vision of SKF and Industry 4.0. He spoke about application driven innovation – and how SKF work to create different bearings for each industry and customer need.

Today, SKF's bearings are fitted with sensors that give instant data and help predict machine performance. In Industry 4.0, factories are digitalized – and processes that once took hours can now be done in seconds. All machines are connected and can be analyzed in real-time, turning big data into smart data. SKF act as a reliability partner, by delivering not only the products but also ensuring the performance through data analysis and insights. SKF strive to create a world of reliable rotation.

FROM TODAY TO WORLD CLASS MANUFACTURING

Torsten Nordgren, Director Future Factory & Business Transformation at SKF, talked us through SKF's strive for World Class manufacturing. SKF have already started their digitalization journey and are using AI in different parts of their manufacturing. SKF work in close cooperation with different partners to achieve World Class operations. Their strategy is to serve customer and application specific needs with new innovations.

SKF are currently working with a technology step-up, digitalizing their factories and machines around the globe. It's a continues improvement project, that can not be done in one day. Digitalization of the factories focus on: refurbishing and upgrading of machines, investing in World Class channels and technology from scratch, and building new World Class factories.





Torsten talked us through the building blocks of the Future Factory – where Flexibility, Automation, Transparency / traceability and People shift are in focus:



Before visiting the automated factory, Torsten explained to us the features and key benefits of SKF's World Class SRB Gothenburg. SKF have created a proactive working environment, resulting in high output and low cost, high flexibility and a manning reduction by 80 %.



World Class SRB Gothenburg

Inaugurated April 5, 2017

Features

- Cells for flexible manufacturing
- Zero resetting machines
- Robots, AGV's integrated
- CoMo for machine health and learning
- Fully automatic roller filling and ass:y
- Visualization and mobility tool
- IG grinding/energy reduction

Key benefits

- High Output, low cost
- High flexibility
- Traceability
- Reduction from 4 to 2 channels
- Manning reduction 80%
- Real-time action taking



World Class SRB Gothenburg

+ ongoing:

- WCM CRB, Schweinfurt
- WCM ILT, Schweinfurt
 - WCM DGBB, St Cyr



When it comes to AI in World Class manufacturing, Torsten pointed out a few areas that could be interesting to discuss when it comes to the effect of working with AI: Way of working (Organisation, Line/Project, Agile/Classic etc), Experiences & lessons learned so far, Competence development, Tolls, suppliers and partners, and How to accelerate.

The biggest challenge, besides the technical parts, is also in terms of competence and leadership, as the factories are currently undergoing a big change. It is important to have the competence at hand when it comes to connections between the machines and systems, where manufacturing and IT need to work more integrated. It is also important with knowledge-sharing between the factories in different countries, so that learnings and improvements can be implemented throughout the company.

Milen Kourtev ended the presentations from SKF by saying that the company is only at the beginning of their journey working with AI, and asked the participants to think about how the technology could be used in new ways within the company and the manufacturing industry.



BACKGROUND: AI

Christian Appelt from Ambient society held a presentation about the advancements in AI and how the technology is used in different industries today.

During the AI & Business workshop at Innovation Pioneers Summit 2018 the participating companies were asked to answer the question: 'Where are you in your company journey with AI?' The majority were currently at the 'Explore' stage (45%), while 16% had moved on to the 'Implement' stage and only 6% had reached the 'Profit' stage.



Christian also went through the different stages of AI – talking us through how the technology has evolved from the early levels of AI back in the 50's through 70's, to Machine Learnings technologies beginning to flourish between the 80's and early 2000, to where we are today: the Deep Learning stage driving an AI boom.

Christian presented a deck of cards with different scenarios where AI technology has been implemented and is used today. These included: Chat bots, image recognition, Digital Twins, Emotion recognition, robotic workforce and NLP (Sentiment analysis and topic modeling).

As an example, Christian talked about how IKEA have worked with AI to analyze and calculate smart phone camera graphics to build an AR app where customers can digitally place IKEA furniture in their own homes before making a purchase. The app also allows you to photograph any piece of furniture and to get a suggestion of a similar piece from IKEA. This process has been created through letting the AI analyze over 500 000 product images, learning how to match other products to similar IKEA products.

The scenario cards were later used during the workshop as inspiration for how AI might also be used in the field of industrial manufacturing.





METHOD - HYPE MATRIX & IDEATION

During the tank meeting the participants used ideation and the Hype Matrix Canvas as an innovation tool to explore different possible uses of AI in industrial manufacturing and at SKF.

<u>I</u>	Adding Value	Society Bunnears
Push Create Likes		Create Revenue
	Cutting Cost	



WORKSHOP - PROCESS DESCRIPTION



The workshop started off with getting to know each other in the team, by going around in a circle answering questions. Each person was asked to present their personal interests / hobbies and also to guess the super power of the person next to them.



Ask questions and be critical

Participants were then asked to start thinking about the most important questions when it comes to working with AI, both at SKF and at other companies. Each person was asked to write at least 3 post-its on what questions they felt were important to answer when improving AI in manufacturing. After that, the groups discussed the most important questions and highlighted these during a 15 minute discussion.

Examples of questions that were asked by the groups were: How do we keep engagement in an automated chain? How do we work for sustainability through AI? What's the customer value? Who owns the data produced by a machine in a factory? How do we show business value with AI? How much knowledge should be internal, and is that knowledge in place today? Can AI be used to better understand the customer needs?







The next step of the process was to look for solutions and needed steps when it comes to revolutionizing industrial manufacturing by AI. This step was done using Ideation & Hype Matrix. Each team was asked to think about what opportunities and solutions there are when using AI to improve industrial manufacturing.

The teams were given the scenario cards with the 13 different types of solutions using AI, the same ones that were presented earlier in the day. These cards were to be used as inspiration to come up with different solutions to be used within the field of industrial manufacturing.

Each person was asked to write down at least 3 solutions / opportunities during five minutes. After that, the groups teamed up two-and-two to choose the best two ideas of their combined ideas. These ideas were to be put on the 'hype matrix' where they belonged – on the scale of Adding Value or Cutting Cost, as well as Push / Create Likes or Pull / Create Revenue.



Elevator pitch - How to start (tomorrow)

The last step of the process, before the final presentations, was to prepare a two-minute elevator pitch to present the team's idea, focusing on the steps needed to kick start the opportunity in an organization already tomorrow.

Each team was asked to describe the chosen idea more in detail, also outlining the key activities needed to implement it in an organization. The teams were also asked to specify what would be needed to realize the idea in terms of: resources, competence(s), possible partners, educations needed, and time. What would be the minimum steps needed to start tomorrow?



RESULTS

GROUP 1 - BEARY THE BRAIN

The first solution was about knowledge combining through AI - bridging the knowledge about the process, big data and products with the operator's experience. By combining all parts in a system you could create 'Beary the Brain' – an AI-powered knowledge and skill-sharing platform.

'Beary the Brain' would be present in the factory to answer questions on everything concerning the operations – accessible though smart voice assistance and chat bots. The group suggested that the platform should be a commitment from several larger corporations building it together.

GROUP 2 - ROB THE PERSONAL ROBOT

When factories are automated and less people work in them, it might feel a bit lonely and unstimulating for the few humans remaining to only work with robots all day. If the robot was given more human-like features, with eyes and a mouth and the ability to talk, work would become more stimulating for the robot operators. 'Rob' the personal robot would be able to talk about business related tasks but also give social interactions like recommending a new song or helping the robot operator practice German a full day. The technology could also connect humans within the factory to each other through knowledge sharing, and the different robots in the factory could also talk to each other to create a more human atmosphere in the factory.

GROUP 3 - BLACK BOX TWIN

The idea was to build a digital twin based on all the data in the factory and package it in a 'black box'. Big data from the manufacturing processes would be stored in the black box to create a digital environment where new materials and processes could be trailed. The AI would work by itself within the black box to find new innovative solutions – optimizing processes, product development, cutting costs, and helping in creating the next generation of ball bearing. The work would be done in close corporation with customers – collecting their data and improving customer value.

On the food waste side, the group also talked about the possibility of using AI to price different products, such as dairy or bread, differently depending on the production date. So that customers had a reason to buy three-day old milk instead of the freshest cartoon - thus reduce food waste. Could the same method somehow be applicable on SKF with their older stock?

GROUP 4 - DATA-DRIVEN BUSINESS DEVELOPMENT

A lot of focus during the day was put on the process, but this group felt an urge to work with the business approach, and to show the true business benefits of working with AI. The group wanted to collect a lot of data, not only from the factories but also from customers, the market and competitors. The idea was for all the data to then be analyzed together with customer data (from customer support) – to really understand the market in real-time and what the customers think of the products.

That would help in product improvements and in forcasting how and when customers buy new products. A search engine could then be made, personalized after each customer, to make personal recommendations in real time. The team also suggested working with a Graf database and digital twins to build a digital environment where new innovation could be simulated and tried.



GROUP 5 - SIMULATED KNOWLEDGE FACTORY

Using AI, the team suggested that we might be able to reevaluate business priorities;

putting human well-being and the planet before product and logistics.

A digital twin would make it possible to test things both in the future and the past.

Creating a new measurement, ROA (Return of AI) instead of ROI. AI would be used to change the standardization for testing and simulating of bearings - create a sense of trust because everything would be trailed digitally before going into production. In a digital environment we can create one million scenarios to discover different questions and answers.

The idea was also to make the platform open for other companies and industries, to create trust and transparency.

GROUP 6 - HARMONIZING BIG DATA

The biggest problem when it comes to big data today is the handling and sorting of data. This group looked at how data can be harmonized and tagged in order to prepare it for usage. A lot of data being put into systems today is not harmonized, for instance different systems might measure temperature differently, collecting Celsius, Fahrenheit and Kelvin in the same input. Data is not tagged today making it hard to work with. What if Al could be used to tag the data automatically, to make it more harmonized and easier to use?

The team suggested setting up a dedicated product team today to make the service available within six months. Harmonizing data before it is used, by creating metadata around it and handling it in a Graf database.



CLOSING THOUGHTS

The SKF team ended the day by concluding that the company is just at the beginning of their work with AI and that there are many interesting and exciting projects and developments to come. The team said they would bring the ideas from the tank meeting with them and thanked all participants for their commitment and showed interest during the day.

During the tank meeting, we learnt that The Hype Martix is a great innovation tool to use to get everyone to contribute with ideas, and to map up where different solutions play in.



Thank you to the brilliant team at SKF for a day of Al, Industry 4.0 and using the hype matrix as a method for exploring how to use Al in manufacturing!

"The structure of the workshop was good. Often you speed ahead in the process and lose steps along the way, so it's good to go step by step. To have time to reflect, give and receive feedback, and then maybe also chose a different patch. I thought it was a good process to work by."

"It was good that we started with asking the questions, because even though we didn't follow them exactly throughout the process, they were still present when discussing different solutions in the end. That way you didn't forget to discuss the most important aspects."

"Using the AI scenario cards was a good way for the group to see different solutions and to talk through them together. The cards could be used as a reference for discussion and ensured that we didn't go for one solution too quickly"





Shared documentation:

Our strive for World Class – SKF Artificial Intelligence - presentation

Tools:

Hype Matrix Canvas Al Scenario cards

Upcoming dates for 2019

Tank Meeting #45 Tank Meeting #46 Tank Meeting #47 Tank Meeting #48 19 – 20 March 2019 21 – 22 May 2019 10 – 11 September 2019 3 – 4 December 2019

Innovation Pioneers Summit 22 – 23 October 2019

