

## Fab Management Forum (FMF)

### Drivers of Digitalisation: What is Digitalisation and Why can it Change so much?



G. Hopf  
Professor for Digital Transformation  
Duale Hochschule Baden-Württemberg (State  
Cooperative University Baden-Württemberg),  
Ravensburg, Germany



#### Abstract

Digital Transformation is often misunderstood as a mere collection of computer-based technologies which allow for more efficient processes and possibly new product or service features. The change brought about by digitalisation however is more fundamental. The keynote will present and discuss the underlying powers of change which drive the digital transformation and which need to be understood in order to grasp and utilize its full powers of “creative destruction”.

#### Biography

Prof. Dr. Gregor Hopf received his PhD at the London School of Economics and is Professor for Digital Transformation at Baden-Württemberg’s State Cooperative University. In his research he specialises on questions of digital transformation namely online business models and online communication. Until 2016 he was the Head of the Taskforce for Digital Transformation of the State of Baden-Württemberg, coordinating all aspects of the government’s digital transformation agenda directly reporting to the prime minister.

## Industrial Internet of Things in Western Digital Wafer Operation



F. Zhang  
Director  
Western Digital, Advanced Data Analytics,  
Fremont, United States



### Abstract

Industrial Internet of Things (IIOT) is a network of sensors, connections, data storage, data processing, data analytics, and automation. It is an important part of industrial 4.0.

WDC HDD Wafer Operation has aged tool bases, many of which are not supported by the vendors any more. To replace the obsolete tools, it would require huge capital investment. At the same time, in order to deliver better performance, every new generation of magnetic head design post more and more challenge on the equipments. IIOT becomes a cost effective solution to address the equipment challenges.

We have developed an IIOT infrastructure with standard components, of which leverages the existing factory system and state-of-art IT platforms. The internal IIOT solution considers the scalability, safety, support, latency, and automation. Several hundreds of sensors were deployed in the production. The internal solution is cost effective and significantly improved the yield. We has demonstrated millions dollars of capex and opex savings from IIOT projects.

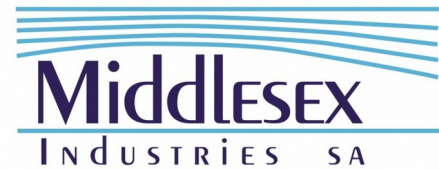
### Biography

Feng is the Director of Advanced Data Analytics in WDC Wafer Operation. His team works on IIoT and advanced analytics. Feng has more than 15 years experience in magnetic head industry from research, failure analysis, yield engineering, to data analytics. He had a PhD degree in Materials Science from Columbia University in the City of New York.

## AMLS Hybrid Implant Technology and Product



G. Horn  
Director  
Middlesex Industries SA, Sorengo, Switzerland



### Abstract

**Automated Material Logistic Systems (AMLS)** are the infrastructures of modern manufacturing. In semiconductor factories there have been a) **Manual Discrete Lot (MDL)**, b) **Automated Discrete Vehicle (DV)**, and c) **Asynchronous Track (AT) Work in Process** transports employed. DV and AT systems span the 200 to 300 mm Wafer format manufacturing. Capabilities and shortcomings characterize each of the above. Integrating the two is superior to either one alone. A new technology c) Hybrid, is the implantation of AT networks into existing DV installations.

b) **DISCRETE VEHICLE (DV) AMLS.** Conceptually simple discrete vehicle delivery is popular. Discrete vehicles delivering wafer lots is easily understood. It is exactly as manual delivery before, but automated. Also easily understood is the dropping of wafer lots from overhead. Therefore, AMSL systems combining these concepts are dominant. They simply automate the manual delivery method. But discrete delivery logistics has no absolute mathematical solution. It works with heuristics. Capacity constraints and system instability, requiring storage, are the draw backs.

c) **AT NETWORKS.** Asynchronous Track AMLS is based on continuous flow of work, massively parallel, and asynchronous. Such networks are always, and immediately available to transport, without capacity constraints. And can respond to load spikes, eliminating instability. And so, reduce fab cycle times. However, they need external hoists to connect to tools.

d) **DV & AT HYBRID AMLS.** Asynchronous Track (AT) network island implants into Automated Discrete Vehicle (DV) AMLS impart greatly increased fab capacity, (balanced process capacities).

Ref: Nonlinear growth of Variance in the Process Gaps. A cause of long Cycle times. G. W Horn, W. Podgorski, PhD, CSTIC, 2020

### Biography

George W. Horn

Mr. Horn received his BA degree from Harvard University in 1961, and his BS/MS degree in Applied Physics in 1963, also from Harvard University. He spent 7 years working at Ilikon Corporation in space technology. The company was a contractor for the Gemini and Apollo space programs. Later he focused on manufacturing science and statistical process control. He is a past director of the Washington based Automation Forum.

During his years at Ilikon he served as Director of Applied Physics (Special Applications of Kinetic Theory). In 1970 Mr. Horn joined Middlesex General Industries as a founder, and served there as Applications Manager. In 1998 He founded Middlesex Industries SA, Switzerland and Middlesex Industries KK in Japan. He now serves as Chairmen for all Middlesex corporations. Mr. Horn has several publications and holds patents related to upper atmosphere simulation, and manufacturing technologies. He has developed the guiding principles for AMHS in Clean manufacturing industries such as Disk Memory Media, Pharma, and primarily Front end Semiconductors, concurrently developing the principles for conveyor based transport of Silicon Wafer Carriers. Globally first, his design was used to build integrated AMHS, direct tool to tool method, in IC manufacturing. His latest studies in AMHS are published in IEEE transactions. He is holder of numerous recent US, China, Taiwan, EU, and Korea patents in AMHS technology.

Mr. Horn is a 20-year resident of Switzerland, where he lives today.

## Cost-effective Automation for Legacy Factories



D. Suerich  
Product Evangelist  
PEER Group, Kitchener, Canada



### Abstract

The Industrial Internet of Things (IIOT) and rise of 5G have increased demand for electronics, and have introduced renewed need for automation at existing 200mm facilities. These “legacy” factories already run at full capacity and have little or no room for expansion, so manufacturers are seeking innovative ways to introduce Smart Manufacturing initiatives, increase productivity, and optimize throughput and yield to meet the increased demands. New facilities built to support older nodes sizes also want to capture market share, and have the same needs as their legacy counterparts.

Although older node sizes and technologies are back in fashion, that doesn't mean these facilities are limited to outdated manufacturing paradigms. Ambitious factories are looking at hyper-automated 300mm facilities to learn best-in-class methods for deploying automation and advanced manufacturing techniques. The SEMI® automation standards related to 300mm manufacturing describe efficient ways to implement automation, and these same models can be used in any facility, new or retrofit, to achieve major gains.

PEER Group® provides products and solutions (including our PEER FACTORY® Station Controller, PFSC™) to rapidly update factory-wide connectivity, data collection, and control systems and allow any factory to integrate new and existing equipment efficiently. We help customers leverage best practices for factory automation and enable the latest advancements in analytics, scheduling, advanced process control, and predictive maintenance.

### Biography

Doug Suerich is Product Evangelist at The PEER Group Inc., the semiconductor industry's leading supplier of factory automation software for smart manufacturing and Industry 4.0. Doug focuses on big data and remote connectivity solutions that help manufacturers collaborate securely on tools and data in production environments. A passionate advocate for smart manufacturing, Doug serves as an active member of the SEMI® SMART Manufacturing Technology Community, Americas Chapter.

Doug has over 20 years of experience leading software teams for a variety of industries including semiconductor, manufacturing, and transportation. Most recently, he was involved in architecting PEER Group's remote connectivity solution, Remicus™, and he was a champion in promoting the use of cloud computing and latest-generation web technologies.

Prior to joining PEER Group, Doug was a software development manager, automation engineer, information systems specialist, and consultant. He has extensive experience designing and integrating robust automation software solutions. Doug holds a Bachelor of Applied Science with Honours in System Design Engineering from the University of Waterloo.

## Correct Material Selection and Life-Time Prediction of Elastomer Parts Using FEA Simulations



M. Gulcur  
Material Development Manager  
Trelleborg Sealing Solutions, Tewkesbury, United Kingdom



### Abstract

Choosing the right elastomer sealing material has utmost importance to maintain vacuum integrity in semiconductor processes therefore keeping the tool downtimes at minimum. Qualification of a new elastomer sealing material brings some risks for the end user as installing a new material can cause contamination or premature failures which can cause more damage than the benefits of the new sealing material. At this point, it is important for an elastomer part manufacturer to provide relevant data to prove the suitability of the material to the application such as plasma exposure tests in various different process gasses, outgassing, trace metal and extractables analyses results and to help understand other factors like the damping behaviour of the material.

During a new material qualification another important topic is to determination of the lifetime of the sealing materials. It is extremely important for semiconductor OEMs to specify the right sealing material and microchip manufacturers to maximize the mean-time between cleans (MTBC). Sealing force created by a sealing part and its decrease over time. By using correct tests on this behaviour for input in advanced Finite Elemental Analysis (FEA), it is possible to predict the lifetime of the sealing parts by simulation. Such an analysis allows to capture the influence of both material properties and seal design on the lifetime. By combining data measured at elevated temperatures, a lifetime prediction for long time scales can be carried out based on test data of short time scales. The FEA will provide a prediction on the loss of sealing force over years and these results allow to estimate how many years the function of the seal can be fulfilled.

### Biography

Murat Gulcur is Material Development Manager at Trelleborg Sealing Solutions UK. He has 17 years of experience in the field of elastomer technology and semiconductors, mainly single molecule/organic electronics. He holds a PhD degree in chemistry from Durham University (UK), has co-authored research papers in renowned journals and holds several patents.

## Incorporating Subfab into Factory and Tool Digital Twins



M. Neel  
Marketing Manager - Intelligent Manufacturing  
Systems  
INFICON, Intelligent Manufacturing Systems,  
Boston, United States



### Abstract

The impact that facilities and subfab components has on the performance of process equipment is important at all levels of manufacturing. As part of an Industry 4.0 Smart factory, the ability to sense all relevant parameters, connect the subfab components to the Digital Twins, and predict performance degradation or failure is critical to providing much needed information and enabling better operations and process control. This discussion will focus on multiple integration and interoperability points allowing for: 1) Integrating pump and abatement systems with a factory-wide FDC system to provide better data collection and analysis to the tool-based Digital Twin, 2) Providing process data and state information from the FDC system to the pump control framework to allow for better predictability of future failure, 3) and FDC system providing full health and state information from the equipment and subfab components to the factory Digital Twin and WiP Scheduling system to provide optimal operational efficiency.

### Biography

Michael Neel is the Marketing Manager for INFICON's Intelligent Manufacturing Systems (IMS) focusing on process control and factory operations optimization. Michael has worked in the Semiconductor Industry for 26 years of which half has been with INFICON providing leadership in process control and factory optimization software systems. Michael graduated from Texas State University with a Bachelors of Science in Chemistry, Masters in Technology, and a Masters of Business Administration from St. Edwards University.

## From Smart Manufacturing Vision to Innovative Advanced Service Solutions



E. Shekel  
Senior Vice President Service Strategy and  
Excellence  
Tokyo Electron Limited, Hadera, Israel

### Abstract

AI technology continuously becomes a key enabler for smart manufacturing. We / Tokyo Electron [TEL] see our equipment on a development roadmap from Single Standalone Tool to providing integrated manufacturing solutions enabled by AI. TEL will provide an insight where we see the actual benefits of data analysis in the process from R&D and Ramp Up, to High Volume Manufacturing. (e.g. Process Optimization and Virtual Metrology.)

Through TEL SERVICE ADVANTAGE, we can respond to our customers' requests and technical advancements promptly. An important component is our remote connection and data analysis capability. TEL analyzes equipment data from various sensors without the need of a physical on site presence, and provides solutions matched to customer-specific needs.

### Biography

Eyal is a twenty-seven years veteran in the Semiconductors industry. Upon his graduation as a Mechanical Engineer from the Technion (Israel leading technical institute), Eyal has joined Applied Materials. In 1997 he has moved-on to Tokyo Electron, served as the Regional Service Manager of Israel, and soon after appointed as the company General Manager.

Since 2005 Eyal has been part of the TEL European senior management, and up to 2019 was responsible for the Service and Support Operations for TEL Europe as a Senior Vice President.

Last year, Eyal has transferred this responsibility onwards, and is now SVP for Service Strategy and Excellence. In parallel Eyal co-leads (as two in a box) the corporate Global Service Committee in TEL Japan.



## How to Replace FSI Tools with BATCHSPRAY® Equipment, while Reducing Chemical Costs and Achieving more Clean Room Space?



M. Buchberger  
Project Development Engineer  
Siconnex, Project Development Engineer, Hof bei  
Salzburg, Austria



### Abstract

A case study, that was done together with a customer, shows the benefits of moving from FSI tools to a BATCHSPRAY® equipment.

Due to that change the customer generated clean room space and reduced the chemical consumption to a minimum.

These benefits were also achieved by a new wafer handling system for automated BATCHSPRAY® equipment. It is called Retainer Comb Handling system (RCH).

With that system Siconnex generates a huge open area on the wafer surface by which a good chemical exchange is given.

This means high cost savings as well as a good return on invest.

### Biography

Mario is Project Development Engineer at Siconnex in Austria.

He is responsible for generating selling potentials at different customers worldwide.

With a wide experience in chemistry and after three years as a Process Engineer he moved to the sales department in 2019.

His focus is on Cost of ownership & Return on invest calculations as well as technical sales support.

## Skills for the Workforce



A. Schleicher  
Director for Education and Skills  
OECD, Directorate for Education and Skills, Paris,  
France

### Abstract

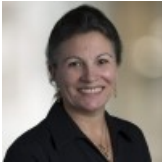
We need to learn for the digital world, but the digital world also opens up entirely new opportunities for learning

### Biography

Andreas Schleicher is Director for Education and Skills at the Organisation for Economic Co-operation and Development (OECD). He initiated and oversees the Programme for International Student Assessment (PISA) and other international instruments that have created a global platform for policy-makers, researchers and educators across nations and cultures to innovate and transform educational policies and practices. He has worked for over 20 years with ministers and education leaders around the world to improve quality and equity in education. Former U.S. Secretary of Education Arne Duncan said that Schleicher “understands the global issues and challenges as well as or better than anyone I’ve met, and he tells me the truth” (The Atlantic, July 11). Former UK Secretary of State Michael Gove called Schleicher “the most important man in English education” – even though he is German and lives in France.

Before joining the OECD, he was Director for Analysis at the International Association for Educational Achievement (IEA). He studied Physics in Germany and received a degree in Mathematics and Statistics in Australia. He is the recipient of numerous honours and awards, including the “Theodor Heuss” prize, awarded in the name of the first president of the Federal Republic of Germany for “exemplary democratic engagement”. He holds an honorary Professorship at the University of Heidelberg.

## Successful Strategies to Attract Young Professionals



C. Pelissier  
Business Line Manager EMEA  
Edwards Ltd, Semiconductor, Burgess Hill, United Kingdom



### Abstract

At Edwards we believe that the successful attraction of talented young professionals to our industry comes from listening and understanding what is important to young people and what they want to achieve in their careers. Our attraction strategy aims to connect with our audiences in more meaningful and emotional ways – we know young people want to learn and opportunities for career development are crucial, but they also want to make a difference, and sustainability has never been more important.

Today's young adults are having to deal with a range of issues which can impact the career choices they make. From the impact of COVID-19 and action on climate change, to challenging cultural attitudes, including those related to gender, racial, mental and physical health discrimination – we believe that businesses who are committed to improving people's everyday lives, as well as protecting our planet offer the most appeal to young people.

Our engagement with the next generation of young professionals focuses on the important issues that matter to them. At Edwards we look to do this through our:

- targeted outreach and social media brand engagement and its real connection to protecting the environment
- global career and development opportunities offered both in our organisation and the semiconductor industry
- promotion of diverse role models representing the wide fabric of the Edwards community and the different careers available

### Biography

General Manager OEM North America -

Leading a team of 10 people with P&L responsibility of ~\$70M revenue from North America OEMs. Re-organized and strengthened the OEM team. Tighten cross functional teams' collaboration (OEM, Division, PC and Service). Drove the implementation and adoption of business processes (EVSP, sales operations (inventory monitoring & control), 8D, PCP (MRS), Feature/Benefits/Value) as a common language in order to increase our competitiveness and business sustainability. Established close collaboration with top 2 OEM customers to maintain our position (first penetration of Edwards abatement at one of top 2 OEM, penetration of EdCentra at both, won 100% MS for major OEM lab expansion (~\$6M)). Additionally, increased footprint at tier 2 customers (DTOR position for N+1/N+2 platform).

## Skills in the Workforce and People in Processes



A. C. Zimmer  
Executive Search & Selection Consultant  
ZIAN & Co industrial consulting and recruitment,  
Munich, Germany

### Abstract

Optimizing people and teams for semiconductor fab manufacturing processes

- Go away from vertical structures and organizations, move into horizontal organizations
- Relocate responsibility to where it is sensible, i. e. to the front-office people handling the job currently at hand
- Create specific, cross-functional teams to deal with specific tasks
- Make sure the best prepared person will lead the team, not the most senior
- Everybody should be aware of the fact that he/she might be asked to step down, if somebody else is better prepared to handle the job at hand
- Stop penny-pinching!

Strategies in attracting young professionals to the semiconductor industry

- Go into schools and universities
- Invite young “high potentials” into the company
- Encourage external support by supporting your local school /university
- Describe exactly why semi is attractive, but tell them: You’ll become addicted, once you’ve joined the branch!
- Communicate, communicate, communicate!

Discussions about critical new skills needed in the microelectronics workforce

- Obviously, the willingness to follow up with the development and the requirements in new technologies and applications
- Furthermore, the willingness “never stop learning”; open communication; flexibility, both horizontally and vertically; give orders and take orders; listen to people: colleagues, clients, suppliers; give and accept remuneration packages which will consider the performance of the company, of the team, and of yourself
- Talks on transferring skills from leading experts to younger people and new hires as part of succession planning
- Start implementing new ideas and visions into the educational, long-term plan of new hires and internal “high potentials”
- Support external schooling, if necessary
- Plan for enough time for classes “on the job”
- Bring in retired people, who might be happy to lend a helping hand
- Discuss the career path with employers at least once a year AND STICK TO IT!

Business insights for anticipating future skills needs

- Home office work
- New communications
- Faster decisions, locally, not at HQ

- More responsibility delegated
- More room for improvement suggestions in terms of organizational and decisional processes
- Stop controlling, let the people do their job

### **Biography**

Personnel and industrial consultant with 20+ years experience. Specialist for High-End technologies (LED, PV, semiconductor, electronics, test & measurement, etc.). Active throughout Europe. Customers in Europe, USA, Asia. Permanent visitor of leading exhibitions and conferences ww (INTERSOLAR [EU, USA, PRC], EU PV SEC, SEMICON, LIGHT&BUILDING, ELECTRONICA, PRODUCTRONICA). Excellent international peer-network (Web 2.0). Fluent in three languages, written and spoken. Experienced sales & project manager, coach, used to handle budgets and lead personnel. Customer, target and solution oriented. 10 years professional international industry experience in controlling, marketing, sales, change management, re-engineering. Team builder

## How to Attract New Graduates into the Semiconductor Industry



S. Edmondson  
CEO of UK Electronics Skills Foundation  
TechWorks, UK Electronics Skills Foundation,  
Livingston, United Kingdom



**UK Electronics  
Skills Foundation**

### Abstract

**"There are some practical things that every single company could do now to move beyond good intentions."**

**Stew Edmondson,  
CEO of the UK Electronics Skills Foundation**

Technology is a catalyst for social and economic change in our constantly evolving world. Electronic products have become essential to society and are a fundamental enabler of our modern, connected, lifestyle.

However, there is a fundamental problem in our country. The UK's participation in and leadership of these technological advances is being limited by a chronic skills shortage in Electronics. Put simply, over a number of years, too few students have been studying electrical & electronic engineering. This, in combination with an ageing workforce, means that there now are insufficient graduate engineers to drive forward innovation and progress.

Based on data recently provided to the UKESF from the Higher Education Statistics Agency, we can see the scale of the problem. The data shows that, in last 5 years, the number of UK domiciled first year students in Mechanical Engineering has increased by 29%, whereas the number of first year students on Electronic & Electrical Engineering degree courses has actually fallen slightly.

So what can companies do? People certainly 'get' the skills issue, recognise its importance and want solutions. The problem is that these solutions are almost generational in their nature. However, there are some steps that every company could take to move beyond good intentions.

We know that recruiting graduates is not straightforward especially as demand is outstripping supply. In addition, attracting the most capable graduates to a business isn't easy - there is a lot of competition for the best Electronics brains. While Tech giants like Google, Facebook and Microsoft are names that will be familiar to these graduates; other companies may not have quite the same profile.

That said, the UKESF believes that you do not necessarily have to compete on the same level. It is important to recognise that Millennials are often driven by purpose and meaningful challenge. It also pays dividends to get a head start and connect with potential graduate engineers whilst they are still studying at university.

### Biography

**Stewart Edmondson** is the CEO of the UK Electronics Skills Foundation (UKESF). He read for a degree in Electronics at the University of Salford and went on to serve 24 years in the Royal Air Force. His military career culminated as the Commanding Officer of Number 1 Radio School, delivering training and education

for all of the RAF's ICT specialists. Subsequently, he pursued his interest in training and technology with a role at QinetiQ, before gaining further commercial experience at Xchanging and then BAE Systems. He has been a Chartered Engineer for over 20 years and was elected as a Fellow of the Institute of Engineering & Technology in 2009.

## The Future of the Semiconductor Market



R. Richter  
President  
EBARA Precision Machinery Europe GmbH,  
Managing Director, Sauerlach, Germany



### Abstract

What are the market drivers for the semiconductor industry? The challenges get bigger and bigger. Energy conservation and optimization of cost of ownership are essential.

Innovative power solutions are needed. The Moore's law extension lets shrink line/space. Leading edge technology for 3D-bonding process to improve the performance and wafer edge conditioning.

EBARA developed several solutions and systems for the semiconductor industry. CMP tools with edge control capability and bevel polish systems to remove edge bead and residual film on top edge. Together with the semiconductor industry, side-by-side, EBARA develops new technologies and application processes.

### Biography

Reinhart Richter is serving as President of EBARA Precision Machinery Europe GmbH since 2015. EBARA is a supplier for CMP and plating equipment as well as vacuum pumps and abatement systems.

Prior to EBARA, Reinhart has worked for over 13 years at Multitest as Vice President Sales and Marketing and later President successfully promoting the company's transition to a leading edge solution supplier for advanced test handlers, test sockets and DUT boards. After the acquisition of Multitest by LTX-Credence, he served the newly formed Xcerra Corp. as Chief Technology Officer. Before joining Multitest, he held various positions at KLA-Tencor Corp., BBN Inc., and IABG.

Reinhart Richter holds a M.Sc. and Ph.D. in Solid State Physics from McGill University, Montreal, Canada, and has authored over a dozen peer reviewed scientific papers.

From 2014 to 2017 Reinhart has served on the SEMICON Advanced Packaging and Test Conference Committee.