Innovation Academy

BEYOND THE BUZZ

How Logistics, Finance, Healthcare And Marketing Professionals Are Using AI

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Introduction

In their report, "Predictions 2017: Artificial Intelligence Will Drive The Insights Revolution", Forrester Research predicts that "insights-driven businesses will steal $1.2 trillion per annum from their less-informed peers by 2020". Statista tells us that this year "the global AI market is expected to be worth approximately 7,35 billion U.S. dollars."

Informa's award-winning Innovation Academy is at the leading edge of these developments. Our newest courses include: AI Fundamentals, Data Analytics & AI for Marketing, Machine Learning and AI in Finance and AI & Real-World Evidence for Clinical Trials and are taught by some of the most authoritative leaders in their fields. In addition, our sister company, Lloyd's Maritime Academy, runs the Certificate in Artificial Intelligence in Shipping, giving us an encompassing view of AI across different sectors.

We compiled a "best of" e-book where we interviewed 34 pioneers on the topic of AI in marketing, healthcare, finance and maritime/logistics. From Wolfgang Lehmacher, Head of Supply Chain and Transport Industries of the World Economic Forum to Forbes 30 under 30 Domeyard Hedge Fund Partner, Christina Qi, the Global No. 1 Fintech, AI, Blockchain & No. 2 InsurTech Influencer by Onalytica, Spiros Margaris to award winning scientist and entrepreneur, ReviveMed CEO and Co-Founder, Leila Pirhaji - learn how 34 of the top artificial intelligence experts in the world are using AI to disrupt their industries, increase profits, drive efficiencies and in many cases - save lives.

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Will AI Replace Marketers?

There is a great deal of buzz, but not a great deal of concrete information, on what artificial intelligence will mean for marketing roles over the next several years. There have been big shake-ups in marketing since the 1990s with the advent of digital, and again since the late 00s with social media; but marketers have, for the most part, been able to adapt. AI however is proving to be something far more disruptive.

We know that a knowledge based, non-repetitive skillset is replicable by AI. The science is there. So, will marketers still exist in 10 years or will they be replaced by technologists who maintain a "team" of AI bots? To find out, several AI and marketing experts – from C-Level marketers with experiences in AI to executives at companies developing AI technology for marketers – tell us what they think the future holds. The list includes:

- Camila Casale, SVP and CMO, U.S. and Canada, Softtek
- Mark Floisand, CMO, Coveo
- Peter Mahoney, Founder and CEO, Plannuh Inc.
- Anna Anisin, Founder, Formulated.by
- Catalina Butnaru, Ambassador, City.AI and London Co-Producer, Women in AI
- Katie King, MBA, CEO, AI in Marketing and
- Alexander Avanth, Director of Business Innovation, PTC Holdings, Futurist, Dare Disrupt.

Their opinions varied, but there were more commonalities than differences in their views on marketing's future.

We've Only Skimmed The Surface Of What Artificial Intelligence Will Bring To Marketing

Accelerating technology will bring a sea change to how we humans relate to our computers over the next few years, and screens may go the way of the dinosaur. In this "voice first" world marketers will need millions of voices that can engage with customers, powered by what else but AI. Peter Mahoney, Founder and CEO of Plannuh says chatbots have indeed been changing marketing - but buzz aside, have not really leveraged AI much at all - at least not yet. Mahoney explains: "If you believe the hype from marketing technology vendors, marketing has been fundamentally changed in the past few years through the advancement of AI and machine learning. While most of us are surrounded by AI-infused technologies, the influence on the role of a marketer has been subtle to date."

"The vast majority of applications of AI are focused on high velocity, rote tasks, like text or image classification, machine learning (ML) ad optimization. These applications are

all quite valuable, improving performance or productivity, but they have not yet fundamentally changed the job."

"There are other applications, most notably chatbots, that have required marketers to think differently about their digital customer engagement strategies, but most of these applications do not really leverage much AI at this point. For most marketers, their chatbot is a simple tool that engages customers with packaged workflows for routing requests or scheduling meetings. There are notable exceptions, including companies like Automat.ai that focus on consumer brands with large scale data sets that support true AI interactions. However, most marketers do not have the available data or the sophisticated customer segmentation in place to support true AI chatbots."

"The good news is that these tools are getting better and require less and less data to deliver meaningful interactions. To prepare for the emergence of true AI systems, marketers should get their data and segmentation strategies in order, so they can take advantage of these advanced capabilities."

"As AI continues to grow in sophistication, it will take on a broader and more strategic role in marketing. Chatbots will cover far more conversations in a richer way - fuelled by much more data gathered from marketers and advanced AI that can learn from smaller data sets. Chatbots will ultimately become "relationshipbots" as they retain context from multiple customer engagements. They will also forge relationships with other consumer bots via mechanisms like the Botchain, an innovation from Talla."

Artificial Intelligence: Making Marketers' Lives Easier Or More Difficult?

Anna Anisin, Founder of Formulated.by, sees things slightly differently and argues that indeed, AI has had an impact that marketers are already feeling: "The AI revolution has forced marketers to be more data-driven. AI has also brought forth new tools allowing marketers to be more efficient and precise in our craft. I'd say that AI is Improving the life of a marketer overall."

Katie King, CEO, AI in Marketing agrees: "Thanks to emerging AI tools and breakthroughs in machine learning capacities, data is now utilised as a means of analysing customer patterns for sales, advertising and marketing purposes, in order to develop automated systems and customer profiles to target certain markets."

Camila Casale, SVP and CMO, U.S. and Canada, Softtek, has experienced AI as "a double-edged sword" but also finds it an "exciting time" to be a marketer. Casale explains: "I think the main thing is that we have much more data to analyze, and better ways to analyze it. For a long time, we've had huge volumes of data that we didn't know what to do with – what audiences buy or don't buy, why they buy or don't buy, where they buy it, what they like or don't like, etc. And over the past couple of years there's been increasing use of cognitive and pattern recognition programs that can analyze all of that data and draw insight from it. So, thanks to AI, the whole process of defining target audiences is becoming much more sophisticated, refined and focused. Five years or so ago, you might target a demographic of women aged 18 to 34. Today, you're able to slice and dice the data to target, say, women aged 28 to 32 who live on the Eastern Seaboard in rented apartments, make at least $75K and haven't bought a phone in the past two

years. Basically, the dynamic is having more and more data to work with, and having increasingly powerful tools to analyze that data and put it to work."

"From an operational standpoint, we're also seeing a lot more automation for activities like email campaigns and follow-ups and automated alerts. While that's not true Artificial Intelligence, we do spend less time doing busy work and have more time to spend on strategy and adding value. Bottom line, what's changed is that we as marketers have a lot more opportunities to be strategic and to have an impact on the business. And with that, there's that double-edged sword, and the expectation from the business that marketing teams need to deliver more value and be more productive. It's an exciting time to be in the field."

Google Rules The World, We Just Live In It

70% of online traffic is owned by Facebook and Google, so it's no wonder that consumers are used to what Mark Floisand, CMO, Coveo, describes as expecting a "Google-like" experience. Floisand explains: "AI has completely changed the consumer landscape and has had a significant impact on marketers. Today's customers, both B2B and B2C alike, have come to expect Google-like access to information, with Amazon-esque personalization. As technology evolves, as do their expectations and AI is the only way to keep up and get ahead."

Floisand continues: "AI is empowering marketers with actionable consumer insight, allowing them to tailor their messaging, content, campaigns and complete digital experience to the wants and needs of their audience. AI and machine learning capabilities enable marketers to make sense of their data and extract valuable and actionable insights. AI also allows them to automatically wow their customers at every touchpoint of their journey at scale, something that was very difficult and time consuming to do 5 years ago and is simply impossible to do at scale by hand."

"This insight gives marketers full visibility into their customers journey, which was once a black hole. AI identifies customer context and intent, equipping marketers with the information they need to personalize the content that's being delivered and the experience as a whole. The results of AI-powered personalization include but are not limited to: more time on site, increased engagement, higher conversions, more opportunities to upsell, higher customer satisfaction and ultimately greater customer lifetime value."

The "Amazon-esque personalization" Floisand describes definitely brings necessity and urgency to the adoption of AI, agrees Katie King: "Personalisation is a huge aspect of the AI transformation within the marketing realm, and is currently the name of the game. So much so, consumers now expect that personalisation. Personalise, or risk falling behind."

"The notion of personalisation is quite simple. One example would include your favourite brand presenting you with products that are curated specifically for you, as opposed to the same three products everyone else sees."

“As a marketer in today’s digital age, it is extremely important to create experiences, which match our audience’s style, shopping preferences, and individual tendencies down to the smallest detail. Marketing’s goal is to drive sales, so if we master the above, then we are on our way to achieving this objective.”

The Marketer Of The Near Future Will Need A System Upgrade

Across the board, all the marketing experts interviewed unanimously agreed that, although they believe marketers will still be around in 5-10 years, there will be a fairly radical change in expectations. Camila Casale has this to say: “I think marketers will spend less and less time doing busy work and have more time to focus on really thinking and on being strategic. We won’t spend two hours analyzing the results of a campaign, for example, because a program will do that and give us a summary. And I think that AI is having that very same impact on any number of fields, that is, doing the routine and rule-based analytical work. As far as being obsolete, I think we will all be obsolete if we don’t continually upskill and challenge ourselves to learn and get better and find new ways to add value to our business. To be more specific, I was talking to an expert in AI a year or two ago about jobs disappearing from smart automation, and he basically said that, if your job involves really specific tasks that can be documented and that are repeatable, your job will probably be done by a robot soon, so you’d better start developing some new skills.”

Mark Floisand takes those thoughts a step further, explaining that the marketer of the future won’t just need more skills, but will need to be a completely different type of person: “Technology is already starting to automate predictable and repetitive tasks, freeing up marketers to do what they do best - connect with people. As AI evolves, so too will marketers’ ability to truly understand what their customers need, and they’ll have more time to focus on creative ideas and ways to innovate. In the next 5-10 years, I believe we’ll have a new and enhanced breed of marketers. We can expect to see an uptick in ingenuity, imagination and out-of-the-box routes to market from marketers that algorithms can’t replicate.”

Katie King argues that not only the type of marketer, but the type of role will need to change: “AI can free up time for higher level strategic work that will most likely lead to greater levels of employee happiness and professional development, not to mention business results. On the flipside however, this does mean that new hires will naturally need to be more strategic, more proactive and moderately more advanced than simply managing the “everyday” “admin” tasks – since this can be taken care of elsewhere. Entry-level positions will look more like mid-level positions do today, requiring more creativity, decision-making and delegation (to a bot).”

Smarter Marketers, Smarter Marketing

AI will certainly change the way marketers work, says Peter Mahoney: “Enhanced conversational AI will require marketers to think differently about their customer touch points to ensure that they are digitally aware, so they can participate in the AI conversation. They will also be forced to think more strategically about customer goals and outcomes vs. individual tactics. Today, marketers are trained to optimize a single tactic, like a digital campaign, with little regard for the overarching customer objective.”

“The back office for marketers will also change fundamentally. Today, marketers spend a large percentage of their time preparing reports, tracking budgets, and consolidating information in spreadsheets. Automating the marketing back office with AI represents a huge opportunity and is the focus of my company, Plannuh, to leverage AI to build, manage, and collaborate on marketing plans and budgets without the need for manual work and spreadsheets.”

“What does this leave for marketers to do? Well, the marketing, of course. The good news for marketers is that by automating increasingly complex tasks and workflows, AI will enable marketers to focus on the more strategic elements of marketing: messaging, positioning, ideas, customer insights, and creative."

Fear Of An AI Planet

Perhaps the scariest thing about AI for us marketers is change. All the marketing experts agreed wholeheartedly however that this change would inevitably be for the better. The way Katie King explains it, the future sounds a lot less boring and a lot more fun for marketers. “Automation and machine learning not only create efficiency and boost productivity but can also result in potentially more satisfying work for the employee due to a reduction in repetitive and mundane tasks.”

“While some sceptics may argue that bots could make marketing messaging and content too predictable, the upside is that marketers will have more brainpower/capacity to augment what bots produce, which means they will have the capacity to add creative touches and outside-the-box campaign ideas to the bot’s automated foundation.”

Mark Floisand reminds us that AI would of course make us more successful at our day to day jobs (and isn’t that the point?). Floisand explains: “AI helps marketers to be more proficient in their roles. In order to be better and faster at getting their job done, tasks that can be automated should be; such as, A/B testing, tracking consumer behavior and identifying trends. The responsibilities that will be taken over by AI are the ones marketers can’t perform, like personalizing millions of digital interactions, according to the context and intent of each individual visitor, in real-time.”

“Many fear that AI will take over the need for marketers but in fact, the opposite is true. The only marketers who are at risk of being out of a job 5 year from now are the ones who don’t embrace AI. Artificial Intelligence will transform, not replace marketers.” Floisand continues: “The key change in the next 5-10 years will be for marketers to build trust in what recommendations and suggestions are being offered up by their AI-powered systems. Marketers’ roles will evolve to manage the process of personalization, rather than the personalization tasks themselves. Given each interaction should be as relevant to the customer as possible, marketers need to get comfortable with every one of those interactions being developed and delivered on-the-fly by AI-powered relevance and recommendation engines, built into websites, apps, ecommerce sites and more.”

Marketing Roles May Actually Be Some Of The Safest Jobs Around

All our worries about no more marketing jobs are unfounded, according to Anna Anisin. "Not to worry, marketers aren't going anywhere. In fact, according to Christopher Whitely, Senior Director of Data Science at Comcast, marketing managers and strategists will be the last to lose their jobs to AI. Someone has to make sure that data is clean and the message and story arc are relevant to your customers/buyers whomever they may be. I only envision more tech and tools to help marketers be more successful at our jobs. The future is bright!"

"The Future Of Marketing Is Not A Competition But A Collaboration"

Alexander Avanth, Director of Business Innovation, PTC Holdings, brings up a compelling point – that AI has far deeper implications in our society which will affect the roles of marketers. He argues that the marketer of the future will not only need to be a data scientist – but also an anthropologist. Avanth explains: '"The way that people think about privacy is changing a bit ... What people want isn't complete privacy.' These words were uttered by Facebook CEO and Founder Mark Zuckerberg back in 2010. Eight years later Mark found himself at Capitol Hill testifying against how Facebook could cost 87 million users their privacy in what can be seen as one of the largest public data breaches. Mark going to Washington is the beginning of a new era of marketing, one that entails both dark ethical dilemmas and powerful user value channels. For those who were surprised by outcomes of BREXIT and Trump, do know that nothing was random, this was all carefully engineered by companies leveraging new AI infused marketing tools. If big data is the crude oil of the 21st century, public social media would be the oil rigs, but the oil refineries are the data analytics and AI companies. Despite the scrutiny of such tools and the ethical considerations of data privacy, these events pave the road forward for what the future of marketing will entail."

"Future marketers will be a mix of data scientists and anthropologists, and their work will no longer be product general but instead be consumer-centric. AI will automate coding and content creation, leaving the marketer to pursue a more humanistic centered approach. This will, in turn, change the narrative of data and marketing from, 'what does data say about selling this product' towards 'what does data say about true consumer value'. In short, for marketers, the future of AI will not be a competition but a collaboration."

City.AI Ambassador Catalina Butnaru is in accord with Avanth's idea that AI will have massive implications for society, and cautions marketers to tread cautiously - and conscientiously - in this brave new world: "The brightest future in marketing that AI has the power to enable for us is a future where each and every one of us has a digital guardian of their privacy to protect their most valuable asset - their digital copy, which includes personally identifiable information and behavioural parameters. This AI guardian of their digital copies has the capacity to negotiate access with brands who want to personalise promotional messages, such that the person's free will is sheltered from ultra-sophisticated nudges, while the person can still maintain and nurture a personal relationship with a business. That's the most promising future."

“In reality, transfer learning and adversarial training will be used to predict and influence shopping behaviour, to the extent that product owners and shareholders allow that to happen. So, I urge everyone who works in marketing and product design to consider the long-term implications of deploying AI that is solely optimised for profitability and cost reduction. Take a step back and find a way to model each person’s best interest as well, and only then allow yourself to use AI or build AI for marketing purposes. The short term wins achievable with AI are not worth pursuing if they destroy the very fabric of humanity.”

AI And The Finance Sector: Innovation Or Misdirection?

According to Global Market Insights, Artificial Intelligence (AI) in the Banking, Financial and Insurance (BFSI) Market is estimated to be worth over USD 2.5 billion in 2017 and is anticipated to grow at a Global CAGR of more than 30% from now through 2024. Not surprisingly, the Asia Pacific region driven by China is leading the way with an estimated CAGR of over 40%. AI has applications that vary widely in finance - from cost savings to improving customer experience and fraud detection - and right now there are already 2.5 million U.S. financial services workers whose jobs are directly impacted by AI.

Finance was one of the first sectors to embrace AI. Sydney Swaine-Simon and Abhishek Gupta write: "The financial sector is one of the first domains to drive interest in using artificial intelligence, even before high computing machines were available. In the 1960s, a lot of research focused on Bayesian statistics, a method used heavily in machine learning. Some of its use cases included stock market prediction and auditing. It wasn't until the 1980s until the majority of commercialization opportunities were explored with expert systems. During that time, over two thirds of Fortune 1000 companies had at least one AI project being developed."

However, with all the current enthusiasm about AI, one Bloomberg headline stood out this past September: "AI Hedge Fund Is Said to Liquidate After Less Than Two Years". Although not confirmed by the hedge fund, this story nevertheless seems to create a crack in what seems to be an otherwise very positive slew of headlines on the "$1 Trillion Opportunity" of AI in finance with its data about AI hedge funds "disappointing investors this year". Several finance, fintech and digital transformation experts discuss what they thought of the story including Christina Qi, Jim Marous, Kunal Patel, Spiros Margaris, Sally Eaves and Theodora Lau. Opinions varied and there were strong AI pro and con thoughts, but as emerging tech strategy expert Kunal Patel reminds us "there are always limitations, challenges and concerns with anything new."

Christina Qi, Hedge Fund Partner, Domeyard LLC, Forbes 30 Under 30

"There's this huge revolution of AI in finance – everyone is so excited about it - but the truth is that very few firms are successful employing AI in finance. AI is exciting, and we've seen a lot of theoretical explorations of AI in finance – but we haven't seen many cases of AI being put in practice at a large scale in our industry. AI usually depends on a large amount of data and that can be tricky.

A lot of hedge funds use 'alternative data' now – for example satellite data that can monitor Walmart parking lots to estimate sales. We can predict how much oil is in a country at a certain time by monitoring the height of oil rigs, or the amount of cargo in cargo ships. Then there are of course funds that monitor Twitter, Facebook or LinkedIn posts. There are vendors out there selling access to this data and there are funds that extract the data internally. Alternative data sounds appealing, but in practice it's difficult to employ these data sets in finance because their relationships to market

returns are weak and noisy, and the quantity of data is very limited. We've seen very few funds finding success from monitoring social media, for example. The edge is slim.

Another problem that comes up, if vendors are selling this data to everyone, evening the playing field, the potential profits go down because everyone will have access to the same data."

Jim Marous, Financial Industry Publisher, Advisor & Global Speaker; Co-Publisher, The Financial Brand; Publisher, Digital Banking Report

"We have researched this subject extensively at the Digital Banking Report and we find that most organizations talk about the application of AI much more than actually doing it. While there are strong case studies around the ability to cut costs and reduce risks, this isn't where the focus should be. Certainly not limited to the way banks are using it today."

Kunal Patel, Product Manager Strategy & Emerging Technologies, 1E

"Like it or not AI is a good thing. It's worth noting that some of the advances in AI can help financial institutions be more efficient, provide better cost savings operationally and provide a better customer experience in the long term. However, there are always limitations/challenges and concerns with anything new.

The main limitation of adopting AI based technology is the cost. Whenever you venture in building something new and revolutionary within the tech space, there are a bunch of complexities which spring up. Moreover, the costs can spiral out of control given the need for continual maintenance in-life.

These complex programmes need regular tender loving care, upgrades and being able to adapt to business changes are a must, especially when financial intuitions are so obsessed with digital transformation. There is also the risk of failure from a system perspective, given the nature of the financial services market, this needs to be managed carefully.

Implementation times can be costly, integration and a lack of knowledge in this area can also be a hindrance, along with interoperability considering the plethora of systems that exist today.

Financial institutions need to consider privacy, transparency, tech complexity and potentially business decisions/strategy considerations with regards to loss and control.

Other potential roadblocks and challenges will be the risk to back and front office workforce, given the advantages of automation, which is a threat across all industries. The knock-on effect is a plan to retrain and redeploy employees and the negativity which won't go away so easily."

Spiros Margaris, Venture Capitalist, Founder, Margaris Ventures; Ranked Global No. 1 Fintech, AI, Blockchain & No. 2 InsurTech Influencer by Onalytica

"AI and machine learning in banking and the financial industry as a whole is the only way forward for any financial institutions that wants to stay competitive. How the financial companies mix the human advisor in the overall service package will be at the end just a choice of how they want to differentiate themselves from their competition. For me, any negative news about AI and machine learning is not stopping me believing in the AI technology as one of the key business drivers for the finance industry and the trend towards even more personalised customer offerings."

Theodora Lau, Founder, Unconventional Ventures; Advisory Board Member, Envel

"Indeed AI is not a magic bullet as it has been hyped up to be. It will not solve all of the world's most difficult problems – nor will it become sentient and destroy humanity. However, that is not to dismiss the promise of AI.

To be effective, however, new technology innovation has to move beyond efficiency and incremental value creation. It is not about being able to pay for your personalized latte 15 seconds faster or get historical reference on your spending via a smart speaker; nor should it be about machines replacing humans. The true value of AI and other emerging technologies in financial services lie in their ability to create new customer value. How can we propel the next generation to greater financial security and help them make the right decisions at the right time? How can financial institutions build trust and empathy to create a deeper, more emotional connection between brand and customer? And how can technology be leveraged to create a more sustainable and equitable society for all?

The future is full of unknowns; the technology is there to help us solve some of them. The question is – are we willing to move beyond the low-hanging fruits and take on the responsibility for our future selves?"

Sally Eaves, CEO Sustainable Asset Exchange (SAX), Forbes Technology Council and Professor of Advanced Technologies

"Within the Finance function and beyond, AI technology and related disciplines (machine learning, predictive analytics, natural language processing, and interactive bots) can be leveraged to add greater value to the business. Benefits span the back office through to front office; including exceptional improvements and impactful increases in operational efficiency, supervisory effectiveness and fraud identification through to customer engagement. This is most evident in personalization of service opportunities through tailored, timely, and tantalizing service offers and product recommendations.

Through the application of assisted, augmented, automated, and autonomous intelligence, each use of AI within Finance creates different types of risks in addition to the positive benefits that result from the application of these capabilities. Innovation

must always be considered in tandem with the new risks that accompany the opportunities created. Lack of awareness is one key factor to consider – how many consumers will fully understand what AI is and how it effects their everyday lives? Further, the effectiveness and efficiency of AI in any field is dependent upon the volume, quality, and timely data upon which the AI models are trained.

More specific risks are related to performance, control, security, ethics, economic, legal, and societal risks. These have the potential for significant organizational impact - both financial and reputational. Additionally, the talent gap with respect to AI skills availability vs. the growing demand for these skills represents another risk. Achieving a diversity of perspectives within AI development teams remains both a roadblock and concern. As adoption becomes more mainstream, these gaps can only be expected to widen.

Indeed, it is this human perspective that will come to the forefront, especially within Finance. When AI is used to create or support a decision, for example a decision to accept or reject a mortgage or loan application, the end user will not know how this decision has come about. These can be decisions that affect the welfare of individual clients – decisions that can change and affect their lives and livelihoods. Further, from an EU regulatory lens, the General Data Protection Regulation (GDPR) provides the user or client the 'right to explanation' around such decisions. How many organizations are in the position to readily comply? So, whilst AI can be employed to accelerate the production of quality nuanced insights and informed decision contributing to greater business success, the use and application of these insights and decisions must be explainable in plain English and must be fully justifiable to those it effects the most."

AI In Clinical Trials Bringing US Closer To Cures

Clinical Informatics tells us that: "Every year in the U.S., approximately 2 million patients participate in roughly 3000 clinical trials; six million patients are needed to meet U.S. recruitment goals. Consequently, up to 90% of trials are delayed or over budget". Experts blame the lack of data available - to both patients and researchers - to explain why only 5% of cancer patients, for example, end up enrolling in clinical trials. A study from Carnegie Mellon University and Albert Ludwig University in Germany predicts that "AI could cut the cost of drug discovery by about 70%" and Krishna Yeshwant, general partner at Google Ventures, estimates "AI would cut (clinical trial) costs by 90 percent."

Artificial intelligence seems like the perfect solution, but Zikria Syed writes in MedCityNews that "clinical trial technologies haven't changed much since the current categories — clinical trial management systems, electronic data capture, and interactive voice response, — were established in the late 1990s." A recent Deloitte study also that tells us "a number of clinical trial activities still use the same processes as in the 1990s." In a sector that is usually at the forefront of technology – biotechnology - it is hard to believe this is happening. I spoke to six innovators who were tackling the massive problem head on – scientists and entrepreneurs working to bring clinical trials to the people who need them – to find out what they are doing to solve the serious innovation problem.

The list of people is impressive for the diversity of solutions they're offering to clinical trials:

- Anna Huyghues-Despointes, Head of Strategy, Owkin
- Simon Smith, Chief Growth Officer, BenchSci
- Leila Pirhaji, Founder & CEO, ReviveMed
- Shai Shen-Orr, Founder, CytoReason
- Daniel Jamieson, CEO Biorelate
- Gunjan Bhardwaj, Founder & CEO, Innoplexus.

Additionally, consultant Dr Chrysanthi Ainali, Co-Founder, DiGNOSIS, shares her thoughts on the specific challenges AI start-ups in clinical trials face.

"Challenges Keep A Lot of Innovators Out of The Market"

"Healthcare brings great challenges for a technology company. It is inherently conservative and risk averse - Hippocratic Oath: 'first, do no harm'" says Simon Smith, Chief Growth Officer at Benchsci. He continues: "There is a tremendous amount of bureaucracy. There is a healthy amount of scepticism for new, potentially unproven solutions—these are, after all, scientists and trained medical professionals you're

talking to. And data is often locked away in silos, protected by privacy laws and proprietary health record formats, even when patients are happy for it to be shared. Such challenges keep a lot of innovators out of the market. But if you believe strongly in your mission and have a great product, you can navigate the challenges and make a huge, positive impact on the world."

Gunjan Bhardwaj, Founder & CEO, Innoplexus confirms Smith's assessment: "Conversations with colleagues, whether AI experts or outsiders without expertise, are always very stimulating and exciting. For most people without exposure to AI, AI is still a term that is not really tangible. Therefore, they are very interested and find what we do very intriguing. Looking at being an AI start-up in healthcare, the challenges we face are quite similar to the ones other AI companies face - from structuring unstructured data to building large enough training data sets to train the AI. These are the points that relate to all AI companies. But what sets us apart from other sectors is that the data we handle is highly complex and often subject to very strict regulations."

Anna Huyghues-Despointes, Head of Strategy, Owkin agrees that being an AI healthcare start-up is both "exciting and challenging". She continues: "We build AI technologies on clinical data and therefore should comply and be at the forefront of preserving data privacy and security. The sector is heavily regulated and therefore closing partnerships can be long. But it is worth it if we can improve patient outcome. We believe that by combining large amounts of medical data with advanced machine learning technologies, we can better understand diseases and heterogeneity of treatment effects. This will be the cornerstone of modern data-driven approaches to precise drug development and discovery. On this real-world clinical data, we build machine learning algorithms to predict toxicity/resistance/sensitivity to treatments and diseases. We have identified these models as those which bring the most added value in the strategic optimization of clinical trials. This will fast-track the best research ideas, improving patient outcomes."

That heavy regulation around privacy is not the only impediment to the work many of these start-ups do. Leila Pirhaji, Founder and CEO of Revivemed explains: "Data sharing is a problem. Data is a currency. When you use data, there is the question of who owns what, who owns the IP, who owns the results."

However, with all the challenges come incredible opportunities Pirhaji points out: "We love it. It's a new era. We are a pioneer in the intersection of AI and metabolomics space. The opportunities for us are growing, it's a really good time to be in the space. It's about the timing too, the computing power to do what we do was not available ten years ago. When you are the first, however, there is uncertainty. The reward is that we are the first."

Daniel Jamieson, CEO of Biorelate, agrees with Pirhaji's sentiment. "Being an AI start-up in drug discovery can be both a challenge and an advantage compared to other tech companies. It's a challenge in that AI on its own is a very difficult discipline. Combining this with drug discovery only broadens the problem space. It's an advantage in that the work you're involved in tends to have greater meaning and that added purpose makes recruitment easier, helps with things like PR and most of all is inspiring to our team on a daily basis."

"AI technologies are a reality, but the question is how we utilize them to make precision and personalized medicine achievable in our lifetime" asks Dr Chrysanthi Ainali. Ainali continues: "Conservatism within the healthcare sector as well as unwillingness to risk new technology that does not provide immediate effect are the main challenges to be tackled. A major challenge will be to understand precisely where AI can help and what its current limitations are. Education of the clinicians as well patients is the first step in order to adopt the AI technologies. Healthcare providers, patients and entrepreneurs need to have a deep understanding of the context into which you are trying to introduce the technology so as to have a smooth implementation and integration into healthcare."

AI in clinical trials is an urgent need to solve immediate real-life challenges for real life patients. Dr Ainali Chrysanthi explains: "Compared to other areas of healthcare, the goal of AI applications in clinical trials will be to close the gap between what patients have access to right now and what they need in the long-term to live healthier, more informed lives. But this needs to be done slowly and with caution to take into consideration various regulatory concerns such as patient privacy and data security."

Shaking Things Up

In Deloitte's "Digital R&D: Transforming the future of clinical development" the authors report: "digital transformation is a complex, resource-intensive, and lengthy undertaking. But the rewards can be significant: Early adopters can benefit from better access to and engagement with patients, deeper insights, and faster cycle times for products in development." The companies profiled here are certainly in line to gain that competitive advantage of being first movers. Daniel Jamieson, CEO of Biorelate: "We've worked with the likes of AstraZeneca, 4D Pharma and eTherapeutics to name but a few. These are companies engaged in early stage drug discovery and are our preferred types of customers. Now that we are launching products we are scaling up our operations and engaging with more clients like this and also in other verticals involved in R&D. These are all typically using cumbersome, inadequate and difficult to use systems that are unfortunately endemic across biomedicine. We are beginning to shake this up."

Another company shaking things up is ReviveMed. Their innovative idea to focus on metabolites is set to revolutionize how physicians will be treating disease in the not-so-distant future. CEO and Founder Leila Pirhaji gives us a crash course on metabolomics: "At ReviveMed we are using AI for drug discovery, by uniquely leveraging data from metabolites, which are small molecules in the human body. There are thousands of diseases with no treatments and thousands of existing drugs that may be potential treatments for those diseases that could save millions of lives. In the last decade, AI platforms have developed to solve this problem using genomic data, but genomic data alone is not enough.

DNA and RNA are really far from what we observe in disease symptoms. DNA will transcribe to RNA then RNA will translate to proteins. These proteins then interact with thousands of metabolites in the human body. Metabolites are small molecules like glucose, cholesterol…. The interactions between metabolites and proteins lead to what

we observe in disease symptoms, they can tell you exactly what happens in a disease. Now at ReviveMed, we are able to use metabolomics to solve this puzzle.

To make an analogy and put what we do in context, metabolomics is where genomics was twenty years ago. Current platforms are only able to characterize less than five percent of them; there are over 10s of thousands of metabolites, and they are very diverse in their structures. Therefore, experimental characterization of all human metabolites is expensive and time-consuming. Our team at MIT developed an AI algorithm to overcome these challenges which we are licensing at ReviveMed."

Taking chances and doing things that have never been done before is the cornerstone of how many of these start-ups operate. Simon Smith of Benchsci: "In a nutshell, we've used machine learning to create something that never existed before: a way to search through and filter research reagents with equivalent ease and precision to conducting an Amazon product search, despite the fact that—unlike with products on Amazon—key product information comes not from vendors, but the scientific literature. It's crowdsourced and, thanks to our AI, parsed and reassembled in an intuitive way.

Our biggest competitors are traditional scientific search engines such as PubMed. But while these are incredible resources, they function in a completely different way—keyword searches, primarily—that's less useful to researchers for finding information to inform reagent purchases."

"Novel Approaches That Can Disrupt (The Current) Paradigm Will Always Have A Chance of Success"

Shai Shen-Orr, Founder of Cytoreason echoes the optimism of his peers in this group of scientists and entrepreneurs: "Healthcare constantly provides a rich seam of needs for new approaches to bring value – especially in our niche of drug discovery and development. Productivity in R&D is declining and costs and timelines increasing. Novel approaches that can disrupt this paradigm will always have a chance of success. If you can demonstrate that you can improve target identification and validation, reduce the risk of clinical trials, and help focus on the right indications and patients you have an important story to tell.

You need to be very focused on the area you want to disrupt, very transparent in your processes (no black boxes to hide in) and very thorough in thinking through how your approach can impact the problems being faced. I think this is something that CytoReason, by design, has been good at."

Shen-Orr continues: "Healthcare is a very dynamic industry, where very big changes, and big dollar rises, can happen very quickly. A quick look at the take-up of biologics demonstrates the speed values can skyrocket – it far outpaced the transition to smartphones for instance."

Taking the Not-So-Obvious Route

There is a lot of negative news about digital health start-ups imploding lately, but ultimately these hardy pathfinders have been paving the way for success for those who

come after them. Outside-the-box strategies are being developed in order to succeed in healthcare, as digital tech innovator Paul Yock succinctly characterized the sector: "The 'move fast and break things' approach that works in tech doesn't translate well to healthcare." Shai Shen-Orr illustrates his unique start-up strategy: "We took a long hard look at the market and saw what was going on. We then made a strategic decision not to engage in activities that lay outside our domain of expertise; activities that take a long time before the success or otherwise of the company becomes apparent. Instead, we focused our time and resources on building our data and the technologies that help create our data – rather than software development and trials. The data we can produce can be validated very rapidly, speeding up significantly our access to the market. This is not an obvious route for a healthcare start-up.

The response from the market supports the decision we made. Our technology was licensed out of the Technion, with a large and long-term commercial project. We followed that up with further collaborations with top tier pharma companies – and there are more collaborations in the pipeline. So, unlike most start-ups, we have been revenue generating since inception, have not been reliant on venture capital, and have a working productive and validated platform.

We have built our entire approach with a very clear focus on the immune system – the checkpoint for a multitude of diseases and their treatment, and still poorly understood at a system – cellular – level. We have a decade of research behind the technologies, the most extensive data sets that leverage data our collaborators would never have access to and have a team of the highest caliber who combine to provide the right direction and investigation for our analyses to deliver the best insights."

Dr Chrysanthi Ainali advocates a cautious approach to AI start-ups, especially since major companies with enormous budgets are their competitors. Ainali explains: "AI is a huge opportunity in healthcare space, which is undergoing a major transformation. Adoption in the actual clinical trial process is still in early stages with a lot of start-ups developing disruptive AI technologies for early diagnosis, driving decisions in drug design, enrolling the right pool of patients for studies, and remotely monitoring patients' progress throughout the study. However, the biggest barriers to entry for smaller start-ups streamlining clinical trials are that: Technologies are relatively new; the industry is more complex and regulated as well slow to adapt and tech giants like Apple, Google, Amazon etc. are developing similar products that might be difficult to compete, thus one will need to identify the correct point of entry and fit these systems seamlessly into existing workflows."

Cost Savings: A Key Benefit Of AI Start-ups

While AI start-ups working in the clinical trials space may not have the visibility of an Apple or a Google, their cost saving benefits combined with their very specific sorts of expertise could provide a win for researchers and pharma companies. Gunjan Bhardwaj, Founder and CEO of Innoplexus explains: "Since we have automated the entire process of data processing from crawling to visualization, we can offer our products at a comparatively low price. This is because most competitors still annotate data manually. It drives the cost of a cured data ocean extremely high. Small biotechs,

hospitals or research institutes cannot afford these costs - and that's where we come in."

"Innoplexus has more than 250 highly skilled colleagues including PhDs, AI experts, Data Scientists and engineers spread across three countries. We combine German quality standards with vibrant Indian innovation culture. Our leadership team has more than 150 years of experience in technology and life science. This gives us a competitive advantage with the power of continuous innovation, being Artificial Intelligence best in class. We have a huge variety of clients – like (big international) pharma companies, biotechs, research organisations, hospitals, health insurance companies, and many more. On the one hand, we work together on projects with our client's data engineers and data scientists to create custom use-cases. On the other hand, we can send you a login right away for immediate use of our products. We cover different therapeutic areas and indications spanning research, pre-clinical, clinical, regulatory and commercial stages of a drug, across therapeutic areas and indications."

Daniel Jamieson, CEO of Biorelate describes their product's evolution: "Biorelate started off the back of building the world's first pain research database with Pfizer and was used to determine novel drug repurposing opportunities. We then continued as a services business, working closely with customers in early stage drug discovery to help advance their R&D using our state of the art technology. We have been building products alongside this work and have been delivering our service work through them. This has helped tremendously with achieving product market fit in a sustainable fashion."

Benchsci offers the ultimate in cost savings - their tool is free to academic researchers. Simon Smith spells out his product's benefits: "Researchers struggle to find antibodies. They get frustrated at the inefficiency of finding guidance on purchasing antibodies in the scientific literature. Then they discover BenchSci, and a lightbulb goes off. They immediately get it, then use it, then tell us how much it's helped them. And don't take my word for it. Just look on Twitter, Facebook, LinkedIn, or Instagram to see what people say. We don't have to convince them to use BenchSci. We simply say: we know your pain, we built a solution. And they immediately get it.

As with many start-ups, BenchSci started when our Chief Scientist, Tom Leung, encountered the problem himself. Tom struggled to find the best antibodies for his own experiments. He figured that something like BenchSci should exist. But when he couldn't find it, he thought that perhaps he could create it. From here, he recruited cofounders to provide the technical ability and business knowledge that complemented his domain expertise. And the rest is history. Or, rather, three years of hard work to get where we are. At BenchSci, we're laser-focused on a specific, widespread problem that delays biomedical research and makes it more expensive.

For non-scientists, I can provide an analogy. Imagine you wanted to bake a cake, but when you went to buy flour, there were 5 million options. And imagine that only a few of these options would work for your specific cake—depending, say, on the other ingredients and type of oven you're using. If you used the wrong flour, your cake would fail, wasting your time, and all the other ingredients. But, unfortunately, the flour manufacturers can't tell you which flour would be perfect for you, because every cake

is slightly different, and they can't test their flour by baking every possible permutation. So how would you possibly know which flour to buy? Probably by seeing what other chefs have used for similar cakes. Right?

This is the case in biomedical research. There are, for example, more than 5 million commercially available research antibodies that researchers can use to measure the level of proteins in samples. To ensure they buy the right antibody for their specific experiments, they search through the scientific literature, and see what other researchers have used. This process can take days to weeks. Even then, it's not fool proof. Researchers still need to validate several antibodies to find one that works. Overall, the inefficiency can be hugely wasteful. Up to 50% of antibodies fail in experiments. Research projects can get delayed for months. Sometimes, researchers only find out deep into their research about a flaw with their antibody, negating months of work and investment, and potentially even resulting in the waste of precious tissue or cell samples. Oh, and by the way, antibodies are just one type of ingredient—called a reagent—that researchers use. So, multiply this problem by all the reagents. Researchers may use 5 or more per experiment.

We use artificial intelligence to decode the world's biological data to reduce the time, uncertainty, and cost of biomedical research. Currently, this means that we (1) ingest data from open- and closed-access publications, vendors, and other sources; (2) use machine learning to decode and extract relevant information from this data pertaining to research reagents; and (3) make this information easily searchable in a user-friendly platform that provides results in an intuitive way for scientists.

Our customers are biomedical researchers who use reagents such as antibodies. It's a small group—probably around 350,000 active academic researchers, and 150,000 active industry researchers. But they're responsible for about $40 billion in annual reagent purchasing. And they're looking for better ways to do their important work. BenchSci is free for academic researchers, and a licensed SaaS product for industry researchers. We have users in more than 1,300 academic institutions globally, as well as 14 of the top 20 pharmaceutical companies."

Maintaining A Competitive Edge

Anna Huyghues-Despointes, Head of Strategy, Owkin explains what sets Owkin apart, in a sector where there are already over 100 startups using artificial intelligence in drug discovery: "We have 2 main differentiators our tech stack and our network. We are developing state-of-the-art transfer and federated learning technologies to overcome the data sharing problem, building collective intelligence from distributed data at scale while preserving data privacy and security. We are federating the largest research network, connecting hundreds of institutions worldwide and fostering collaborations at an unprecedented level.

We have one product: Socrates. It is our proprietary software platform, installed on-premise or in the cloud, engineered to be used by clinicians and researchers (with advanced statistics skills or without any ML expertise) who build their own predictive ML models, on their own datasets, while benefiting from the integrated annotation platform, the autoML tools and zoo of pre-trained models, the predictive power boosted

by transfer learning [and in the future: multimodal data integration, federated learning collaboration]. Our partners are oncology centers, hospitals, research institutions. Our clients are pharmaceutical companies. Our partners and clients are scaling their internal bioinformatics and ML resources as they understand the value of AI. They work with us for our expertise in ML applied to medical data and our research network."

Daniel Jamieson of Biorelate relates how his competitors are often potential customers: "There are many interesting companies that could be perceived as competitors to us, although we typically find that these are potential customers as what we have is so unique. Our platform, Galactic AI, is very much focused on curating data from text, so we're a text analytics company. However, the most important thing that we offer is a commitment to address clients from the perspective of their problem at hand. Problems like uncovering novel drug repurposing opportunities, investigating mechanism of action, sourcing expertise objectively, and knowledge intelligence. This is our bread and butter and parts of which we are now patenting."

Shai-Shen Orr describes his company's research journey and how it has given them a competitive edge: "We did a piece of work quite early on, in inflammatory bowel disease, which proved the capability of our concept. The search for an elusive blood-based (as opposed to tissue based and therefore not requiring a biopsy) pre-treatment marker for a specific type of therapy, in a major and highly competitive segment, had been going on for years, costing millions of dollars. In just a few weeks, we uncovered both a validated biomarker and a target – in a disease that is impacting millions of people! We clearly had something to build around.

Our approach offered the chance to create a computational model that can deliver the fast and accurate insights and hypotheses that are vital if you want to break the paradigm of drug development processes that take decades to complete and cost billions to conduct. Building on that we created disease and tissue models at a cellular level – cell-centered models - that act as a blueprint for immune activity, and which allows the integration of new data in a way that can deliver not just directional insights but also causal understanding of the cell, cytokine and gene relationships. Leveraging public and proprietary data we apply a multi-pronged technological approach that: Enable the rebuilding of cellular composition from bulk tissue data; is capable of normalizing inter-personal cellular variation and mapping back to culprit genes; allows for integration across data types; that brings the context provided by the body of known evidence; and that keeps your model learning and growing with every new data set.

It's a kind of Waze GPS for the immune system. It not only knows which direction cellular traffic is operating in, it can also isolate the cause of hold-ups and navigate a way around them. In addition to building a clearer picture of what's happening, it also enables you to squeeze enormous value out of single or smaller and imperfect data sets. These critical insights enable you to discover new targets, validate existing targets, understand mechanism of actions, stratify patients (and find the right markers), and plan indication selection and expansion in a much faster, more accurate way – and do so within weeks rather than months or years and at a much-reduced cost."

Shai Shen-Orr points out how CytoReason differentiates themselves: "This is a young burgeoning industry overflowing with new companies appearing out of nowhere claiming to be a key driver of the AI revolution. There are many companies claiming to do what CytoReason does, and in a similar manner, but the reality on the ground is quite different. Our technologies, data and process are all unique and proven, but it is the three core principles upon which all our tech, data and process are built upon that really sets us apart. We deliver biology to biologists and avoid the black box – as the only company to focus on understanding the immune system at a system – or cellular – level, we replicate biological processes to answer biological questions, with validatable results based on a methodology and rationale that is transparent, understandable and applicable to the development process you need to impact. In this way you avoid the "black box" phenomena of data being poured into a mysterious algorithm and a requirement to take a leap of faith in the results.

Shen-Orr continues: "Continuous Improvement - We developed a learning model that gets richer and more accurate with every new data set (including clinical trial data that is normally a closely guarded secret), from every new collaboration – but that does so in a manner that maintains confidentiality of data and the questions and resulting answers being asked of, and generated by, your model.

Collaboration first, last and always – We have built our business around the needs of our collaborators and around the need to discover and deliver valuable IP to our customers – not to compete with them. As such we do not seek to build our own internal pipeline. This changes the way we do everything, because our success is intrinsically tied to the success of what we deliver to our collaborators."

Collaboration For The Common Good

In an industry which is still reeling from a much-publicized patent lawsuit, you would think biotech would become ever more secretive to avoid grey areas. On the contrary, many of these AI start-ups are built on a collaborative research ethos. Shai Shen-Orr, Founder of Cytoreason: "We have built our business around the needs of our collaborators and around the need to discover and deliver valuable IP to our customers – not to compete with them. We believe this is one of the key reasons why CytoReason is already working with our core customer group – leading pharma and biotech companies and prestigious research. In the case of one collaborator, their need was to harness collection, integration and learning from the data generated from multiple independent sites, hundreds of clinical trials and millions of data points. More importantly, given their focus, they needed an ability to be able to squeeze maximum insight from small and often imperfect data sets. CytoReason showed how this can be done revealing important new mechanisms of action that can direct future research efforts.

In another recent example, we presented an internal mechanism of action analysis that we did in atopic dermatitis. Using only a single data set and taking just 4 weeks we uncovered a new mechanism for a marketed drug. Our hypothesis was then cross-referenced against confidential clinical trial data, that had taken more than two years to gather and analyze. To the dismay of many in the room, their as yet unpublished

data confirmed our findings exactly! So, without the approach brought by CytoReason the alternative would be to spend years and millions of dollars on traditional pre-clinical and clinical study methodologies – and still not fully understand the data or the context of that data in the bigger scheme of amassed knowledge. And in the end, still living with the prospect of increased clinical trial risk, longer odds of success and reduced R&D productivity."

Making A Difference

Personal experiences often fuel our life goals, and the ambitions of these scientists and start-up entrepreneurs are no exception. Gunjan Bhardwaj, Founder and CEO of Innoplexus relates how a friend's battle with cancer was a primary motivator for him: "The biggest difference (between healthcare start-ups and other tech start-ups) is the purpose – helping patients to get the best possible treatment. We already had several cases where friends, relatives and others came to us with a severe diagnosis and asked us for advice. Here you feel especially good if you can help patients directly with what you have created in recent years and with immediate feedback. Innoplexus is disrupting how data and analytics is produced and consumed. We are structuring the world's unstructured information in an automated manner. To use the power of artificial intelligence, machines need the data to be structured. We always talk about digitization in healthcare. But there is so much knowledge that cannot be retrieved in real-time on a finger-tip if at all.

With the help of proprietary, patent-pending artificial intelligence, blockchain and big data analysis applications, we have crawled, aggregated, analyzed and visualized all public available structured and unstructured Life Science Data. A second approach is to enable a secure access to unpublished data. For this we use Blockchain. This opens data silos and democratize intelligence. We build the world's largest Research Graph. We extract entities and relationships from billions of web pages automatically enabling real time analytics in context throughout the drug development value chain. Our experts trained our AI in the specific language used in life sciences, covering more than 26 million concepts and semantic associations in order to give our customers relevant insights through intuitive, interactive visualization. Thus, our customers can access all relevant clinical and medical data in a logical context, being constantly updated and delivered to the workstations of customers. On top of our data ocean we build use-case driven applications and offer standard products as well as customized solutions.

If a beloved family member or close friend becomes seriously ill, you want the best treatment and cure for them. This is how the idea of Innoplexus and its products came about. A few years ago, a good friend was diagnosed with cancer, and we were desperately looking for possible therapies. One finding was, that the internet provides a lot of knowledge – but the known search technologies were not sufficient enough to make it accessible. Consequently, we made it our task to develop new technologies and products.

AI and blockchain are only valuable if they solve real problems – like those we see in healthcare. Democratizing data can trigger a new paradigm of AI driven innovation in Life Science. At the same time, it will make access to information more equitable for all

stakeholders. Once data is accessible, stakeholders will focus their efforts on creating effective therapies for better healthcare outcomes. That would truly be the biggest contribution of these disruptive technologies to mankind. That's what we are striving towards day by day.

On the way to developing these technologies and products, we often and intensively collaborated with some of the largest pharmaceutical companies. This is how we have understood the pain points of the industry today. The cooperation has had a profound impact on product development, and we have increasingly focused our products on the real-life challenges that stand in the way of affordable and effective treatments for patients."

Simon Smith, Chief Growth Officer of Benchsi reflects on his company's calling: "Healthcare offers unique opportunities and challenges…One of the biggest opportunities is to meaningfully improve people's lives. Imagine coming to work every day, knowing that what you do has the potential to benefit millions of people (or more). That you can play a part in saving and extending lives, in treating and curing disease. It keeps us focused and engaged.
The nice thing, in my opinion, compared to working in many other fields, is that even on a bad day, when things aren't going your way, you can feel good about your work. And about the people you work with, who are similarly passionate about making a positive difference in the world."

Leila Pirhaji, Founder & CEO, ReviveMed best summarizes what everyone in this group sees as the definition of success in healthcare: "We do our best to make an impact, for us this is the success. That's what we care most about, saving lives.

Uncharted Waters: Maritime Blazes A Trail With AI

As recently as last year, digitisation in the shipping industry was viewed with apprehension. For example, in our article, "6 Maritime Start-ups that are Changing the Game", Vesselbot CEO Constantine Komodromos described shipping industry reactions to an e-auction platform for freight: "A large number of market participants coming from various seniority levels was stating that digitization is just a topic to be discussed at conferences, and not something that could be potentially reforming the market."

Fast forward to the present and the active adoption of disruptive technology has now become a reality with cargo shipping companies such as Kongsberg, Rolls Royce, OOCL, CMA-CGM, Maersk, MOL, DNV GL and Wärtsilä, Ferry Operator Stena Line and Cruise Line Carnival all incorporating digital technologies such as machine learning and AI.

Whether shipping organizations work together with huge companies such as Microsoft and Google or one of the many new maritime start-ups (whose numbers have recently exploded with "more than $3.3 billion …invested in digital start-ups in the shipping and logistics sector") it appears that shipping is not just ripe for change anymore, it's changing. If you need more convincing, a recent Inmarsat survey of 125 global ship owners found that "ship owners are far more open to deploying IoT tools for analytic, management, and operational purposes than some other industries, including mining and agriculture" and "average expenditure per business on IoT based solutions will amount to $2.5 million over the next three years" while IDC tells us that "The DX (digital transformation) programs that will receive the most funding in 2018 are digital supply chain and logistics automation ($93 billion)". An industry that has often been described as "behind the times" is now proving itself to be quite the opposite. With this in mind, several experts in shipping and maritime innovation and technology, representing both large organizations and start-ups, share their thoughts on how they see AI impacting the shipping industry right now.

Wolfgang Lehmacher, Head of Supply Chain and Transport Industries, World Economic Forum

"At times, 8% of the world bulk carrier fleet has been stuck at anchorage. With bigger ships resulting in lower frequency services and greater volume peaks the situation will not improve. Port congestion is part of the flow and volume forecasting and management challenge. Artificial intelligence, in conjunction with internet of things and big data, can improve visibility and predictability. Recently, the Port of Rotterdam and the Port of Hamburg have started to share port call data to optimize calls of liners. The solution is not solely technical though: shipping contracts and berthing priority policies need also to be adjusted."

Mike Konstantinidis, CEO, METIS

"The biggest problem for the shipping industry that AI can solve is the most obvious one: maximizing profits. In maritime it is all about using minimum resources for

ensuring maximum efficiency of engines, optimizing routes, improving cost-effective operation of equipment onboard and of course, minimizing fuel consumption. Our company's product METIS is a cyber "personal assistant" for vessel monitoring and management which is powered by AI (Artificial Intelligence). METIS interacts with all executives at a shipping company via Natural Language Processing, dramatically decreasing the time required for daily decision making, regarding vessel performance analysis, engine and cargo monitoring, operation safety and regulatory compliance. The software detects noteworthy events, makes complex prognostics and diagnostics, prepares reports, proposes corrections and calculates KPIs to achieve the desired optimum performance."

Thomas Bruun Clausen, Business Development Manager, Alfa Laval

"Seen from a supplier's point of view AI will be able to empower shipping to turn ever increasing complexity from a challenge to an opportunity. It will allow us to scan that complexity faster, getting to asking the right questions and increasing learning loop speeds. And it will allow us to then scale that knowledge faster through decision support systems. As the biggest supplier of maritime process equipment, Alfa Laval, we use our knowledge and experience daily to improve our customers processes. AI being an exponential enabler of speed and scale, it is among the tools we use to scale our knowledge, helping us to go even deeper and wider for the benefit of our customers."

Dr Nikos Loukeris, Lecturer, Hellenic Open University in Finance; Adjunct Lecturer, Athens University of Economics & Business in Banking

"The major problems today in the shipping industry that AI can solve are many and include: shortage of human work-force replaced with AI-robotic applications; management of environmental protective equipment and devices to meet new environmental regulations; cybersecurity which can be met with upgraded image and voice recognition, threat detection and cyber risk protection; costs can be controlled and diminished under thorough applications of AI in various phases of the business cycle; the larger size of vessels which can be faced by creating intermediate size vessels that supply the containers of dry/wet cargo to the terminal ports, supported by AI models that reduce costs; and finally the losses of distressed shipping companies can be restricted with AI applications that make the complicated processes of decision making more logical thus offering an effective corporate performance. Microsoft is creating a new AI application in SE Asia with a large team of experts to support the shipping industry, so in very short time it will be introduced in business practice."

Douglas Diggle, CEO of Product & Brand Management, AOG & Company

"Cruise lines are usually years behind land-based hotels but with the industry building a record number of 117 new vessels, new automated and smart processes are allowing data-driven decision-making leads to greater marketing efficiency and a total guest experience. This is giving brands a competitive advantage and increased on board revenues. Many of us have a virtual personal assistant at home and now we have cruise vessels integrating innovative voice activated conversation tools that use artificial intelligence to intelligently communicate, learn about guests, and predict the

needs of passengers, as well as to suggest interesting recommendations. As soon as 2019 you can have a personalized experience on board where passengers can communicate with the digital assistants in English, French, Italian, Spanish, German, Brazilian Portuguese and Mandarin."

Nidhi Gupta, Co-founder & Director, Portcast

"In my view, the biggest problem for the shipping industry right now is the inefficient use of data. To give a concrete example, today if we purchase an airline ticket, it's a dynamic price based on demand and supply that the airline estimates. If we ship cargo though, it's still a largely intuitive and relationship-based decision. This is because the maritime industry is still making decisions based on historical data, market averages and intuition. And because the industry is highly prone to external disruptions (like weather, trade markets, geopolitical environment), it leads to immense firefighting. This is where Portcast is helping maritime companies like shipping lines, forwarders and ports, to combine their historical data with external real-time datasets (economic, climate, sentiment and geospatial) and use advance machine learning to help make predictions of demand and cargo flows more accurate and ultimately pricing decisions more profitable."

Michael Johnson, Founder & CEO, Sea Machines

"The maritime industry today is highly manual and has a relatively high accident rate, largely due to human error. Sea Machines recognizes one solution to this includes deploying advanced perception and situational awareness technology, using Artificial Intelligence powered by deep learning aboard commercial ships. Such technology is closer than many realize: Sea Machines will trial it starting in Q4 aboard a Maersk container ship. This product is expected to improve at-sea situational awareness, object identification and tracking, and will provide intelligent information directly to the wheelhouse. Ultimately it will increase the safety, predictability and productivity of real-world shipping operations."

Constantine Komodromos, Co-Founder & CEO, Vesselbot

"In my opinion there is not just one big problem that artificial intelligence can solve but a large number of these that the industry faces in its day to day operations. The fact that our industry lags behind other markets in regards to the way it utilizes advanced technology makes it uncompetitive and outdated. Technology could assist it to operate in a more optimized and efficient way.

VesselBot, in association with a large Ship Owner has proven that AI can significantly enhance fleet performance in regards to TCE significantly. Shipping companies usually look to optimize the performance of each vessel separately rather than looking at the entire Fleet optimization. By utilizing AI millions of instantaneous, real time calculations and screening of variables – something that humans aren't capable of doing which AI does – can enable companies to achieve better results in regards to their Fleet TCE."

Bjørn Haugland, Chief Sustainability Officer, DNVGL

"We see that data driven compliance may drive efficiency and transparency throughout the supply chain. Insights from data and data driven models along with ledger technologies may gradually replace physical inspections, document reviews, certificates and greatly impact the regulatory frameworks.

The move towards autonomy will completely depend on data and data driven modellings and have the potential to improve safety at sea and reduce environmental impact.

Data driven modelling may also contribute significantly to reduce fuel consumption and emissions through enabling more optimal commercial operations as well as efficiency management of the individual vessels.

DNV GL is deeply engaged with the shipping community to ensure safe and sustainable adoption of the new technologies through e.g. establishing recommended practices for verification of algorithms and data value chains in areas like safety management, energy efficiency and digital compliance."

Inna Kuznetsova, President & COO, INTTRA

"The use of chatbots for simple help in electronic transactions and operations are the low-hanging fruit right now, followed by the use of Artificial Intelligence (AI) in more complex areas such as global trade compliance. INTTRA is already incorporating chatbots with some of our new products such as C-FAST - an automated container forecasting and allocation solution that optimizes expected shipment volumes with carrier contractual agreements. We also leverage machine learning to enrich data in such services as ocean schedules. Going forward, the industry will see more of standardized operations fully automated with the help of AI - from accounting and billing to capacity planning, cargo visibility and global trade compliance."

Tor Jakob Ramsøy, CEO, Arundo Analytics

"The two categories for which AI holds the most viability as a solution include individual vessel performance and fleet optimization. In terms of improving individual vessel performance, AI can be leveraged to optimize fuel and resource efficiency, manage emissions, improve system uptime and drive predictive maintenance. For fleet optimization, AI can be used to optimize scheduling and logistics in real time, as well as determine the fastest and most efficient shipping routes. In May, Arundo partnered with DNV GL's Veracity, an open and secure platform providing an interface for shipping professionals and organizations to access technology, data and services from key providers in the maritime space. Through the Veracity platform, Arundo provides end-to-end data analytics for several fleets, including streaming data from ships en route, providing offline analytics capabilities, and insights in categories like performance forecasting for vessels.

In 2016, Arundo also worked with Carnival Maritime, leveraging machine learning and their own domain expertise to determine how much potable water the ship needed to

have on board, while minimizing costs and fuel consumption. Arundo's machine learning-driven solution incorporated data from sources like the ship's passenger manifest, routes and distillation capacity."

Dino Mandić, Founder, SailRouter B.V

"Today the biggest challenge for the shipping industry is to analyze a huge amount of data collected during ship navigation in order to learn about ship behavior on waves. The main target of that is to use historical ship data to optimize the next voyage. Any data analysis is a more suitable task for artificial intelligence than for humans, especially when an output must be issued very fast. Current ship technology enables collecting data from sensors about every piece of important onboard information but there is no sensor which can measure sea waves during navigation. Our approach is to use artificial intelligence to recognize sea waves during navigation based on ship motions."

Valentin Perret, Head of Business, Shone

"One of the biggest challenges the shipping industry is facing right now is an information problem. There is too much information available onboard ships for the crew to be able to take the best decision at the right time. Yet, ship operators only have incomplete bits of information reported to them from the ships.

With CMA-CGM we use artificial intelligence to map their ship environment and display only relevant information to the navigating crew at the right time while providing comprehensive real time data to their fleet centre. This solves the information overload for the crew while allowing the fleet centre to better optimize their operations."

Nick Chubb, Head of Growth, CargoMate, Founder, Antares Insight

"By far the biggest problem AI can solve within the maritime industry is security - both physical and cyber. It's still too easy for criminal gangs to smuggle illicit goods or weapons across borders by sea and as we embrace digitalization, cyber-attacks on maritime infrastructure will only increase. It's not currently possible for every single person or vehicle that enters a port to be properly checked. But AI powered security platforms are able to monitor vessel movements, customs declarations, and even CCTV footage to flag up suspicious behaviour to security teams. UK start-up Zasti uses a powerful deep learning algorithm to recognise suspicious people from CCTV feeds. It can flag up known suspects to human security teams and even predict criminal behaviour based on the actions and facial expressions of people captured on video. Another UK start-up, DarkTrace, has developed an AI based cyber immune system which automatically learns to spot cyber-attacks and shut them down as quickly as possible."

Meet Our AI Trainers

Katie King, MBA is a regular international speaker and frequent commentator on BBC TV and radio. She has delivered talks on TEDx and is a recognized expert and commentator on social business strategy and digital transformation. Her marketing and consultancy career spans twenty-nine years, and in that time, she has advised and trained global brands including Huawei, Alcatel, Montcalm Hotels, Accenture, Harrods, O2, Virgin, Arsenal Football Club, NatWest, and many more. She has interviewed leading global brands, tech disruptors, venture capitalist firms, and more for her book on AI in Marketing.

http://www.innovation-academy.co.uk/courses/data-analytics-ai-for-marketing/

Dr Chrysanthi Ainali is a bioinformatician and consultant with expertise in the integration of AI technologies and techniques. She has a PhD in Machine Learning and Translational Medicine from King's College London, where she focused on the development, validation, and application of Machine Learning algorithms to the integration of genomic data for biomarker identification, disease subtype identification, and patient stratification. In 2017, Chrysanthi founded DiGNOSIS to provide professional consultancy and data science services for pharmaceutical companies, and to pioneer the application of AI to clinical trials. Prior to founding DiGNOSIS, Chrysanthi worked for Thermo Fisher Scientific, where she drove the bioinformatics component of designing and developing clinical genetic tests, as well as the customer rollout of bespoke bioinformatics workflows.

http://www.innovation-academy.co.uk/courses/ai-and-real-world-evidence-for-clinical-trials/

Petros Geroulanos is a FinTech consultant with over 25 years of professional experience in trading, product development and sales. As former head of VEGA Structured Finance GmbH in Stuttgart, Germany, he introduced default-free ABS to medium-sized corporates using data analytics. He has worked for Swiss Bank Corporation, Union Discount PLC in Zurich and London – where he was engaged in trading, selling and structuring FX, Equity Exotic and Fixed Income Derivative Products as well as their underlying cash instruments.

http://www.innovation-academy.co.uk/courses/machine-learning-and-ai-in-finance/

Dr Nikos Loukeris is a university lecturer and leading academic in the field of Artificial Intelligence's applications to industry. Nikos has accumulated several academic qualifications, including an MSc in Mechanical Engineering and Production Management, an MSc in Economics, a MPhil in Engineering and Industrial Management, an MSc in Computational Finance, and most recently a PhD in Finance and Artificial Intelligence. Alongside teaching at European and American universities, he has also contributed research to international financial conferences.

http://www.lloydsmaritimeacademy.com/event/artificial-intelligence-in-shipping-distance-learning-course

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