THE STRATEGIC VALUE OF DIGITAL TRANSFORMATION

INTERVIEW WITH JITENDRA MUDHOL FOUNDER AND CEO OF THE COLLAMETA STARTUP

Thought Leader. Entrepreneur. Data Junkie (Machine Learning, Deep Learning). Impact Strategist. Deep Learning, Predictive Analytics, Jitendra S. Mudhol has worked for nearly twenty years in various geographical and cultural contexts at Siemens, IBM, Toshiba, Fujitsu, Sanyo, Qualcomm and Broadcom. Founder and CEO of the startup CollaMeta, specialized in the development of dedicated solutions for the world of Utilities and Manufacturing, he was defined by those who met him and worked with him as a "**highly innovative thinker**"

WHO IS JITENDRA MUDHOL?

I am a curious soul, with a humanist heart, an engineer's brain and a mission to create a world that's just and harmonious with nature. I grew up in India with Dad an engineer,

and mom the perfect home-maker. Owe them everything. Grew up valuing reading, learning and curiosity
Studied Electronics and Communication Engineering and my first job was with Japanese engineers from Sanyo. Switched early to writing software for Siemens public switch. My technical streak has continued through real-time code for Toshiba's CAT scan machines, IBM's e-beam Lithography, deploying WiMAX solutions, implementing the Security Layer of 4G protocol for Qualcomm and now deploying Machine Learning algorithms. I have founded or co-founded three companies, my latest focused on Machine Learning. My team's strength is to understand the socio-cultural

context of a business problem and then applying appropriate Machine Learning techniques to solve it. **Unearthing the value from intangibles opens the eyes of our clients who embark on digital transformation**. I strongly value giving back and twenty percent of my team's expertise is dedicated to social ventures and impact investing. As an Executive Fellow at the Santa Clara University's Miller Center for Social Entrepreneurship, I am formulating the strategy for harnessing the power of Data Science and Machine Learning in its ecosystem of 800+ social ventures across all continents.

WHICH IS THE STATE OF THE ART IN DIGITAL MANUFACTURING IN AMERICA? WHAT IS THE GAP BETWEEN USA AND EUROPA?

A 2016 BCG study found that the pace of adopting Industry 4.0 was about even between US and Germany. But in the last few years, US has fallen into the middle of the pack in total-factor productivity growth, well behind Japan and Germany. Number-wise, **only about 2-5% of US manufacturers are fully digital and automated**. 20% are paper-intensive. The rest are somewhere in-between. Remember, more than 80% of the industrial base is made up of small and mid-sized companies and they don't have a good enough understanding of the new technologies.

Despite this new government coming to power based on boosting manufacturing, there is no national digitization program nor any such policy. In fact, it is important to zoom out and understand that digital manufacturing fits within a larger context of digital economy. And, there's a missing political debate around the digital economy in the US. The Digital Evolution Index 2017 highlighted that the US is in grave danger of lagging behind. Some good news: Digital Manufacturing Design and Innovation Institute (DMDII) has 300+ partners and a 24,000 square-foot manufacturing floor and boasts of exciting developments like the Cyber Hub for Manufacturing, McKinsey's Digital Capability Center and Dean Kamen's Advanced Regenerative Manufacturing Institute.

Some bad news: America Competes Act – to identify emerging and innovative technologies is no match for European initiatives like EFFRA and Connected Factories.

Among startups, for years hardware startups have always been "the ugly stepchild of venture capital". In the last few years, IoT and IIoT startups got some funding, peaked around Q2'15 with about $317 million going into 26 deals, but again this has fallen steadily since.

DIGITAL TRANSFORMATION: HOW DOES A TYPICAL DIGITAL MANUFACTURING JOURNEY LOOK?

The journey of a manufacturing firm to go Cyber Physical is slow, messy and uneven. One way to view and approach this journey would be as a sequence of sprints. Zoom in to micro-assess each sprint opportunity. Zoom out to have the big picture and see the value in the marathon. Typically, when working with our clients, we start off with a series of detailed assessments which help us to classify the firm into one of the four categories: Digital Masters, Fashionistas, Conservatives and Beginners. Using these assessments, we create a Readiness Index that gives a sense of the status before beginning the journey. The assessments also highlight the prioritized business problems that the client has, and we calculate the strategic value of the digital transformation steps. This helps us to identify the right pilots to begin with. We ensure there's executive buy-in, perform quick small iterations, measure as much as possible.

It is vital to make these pilots and sprints additive. Avoid quick-fixes, tone expectations. For example, **improving the data quality by 10% increases the labor productivity by 14% on average** [Source: Barua et al., 2013]. Improving data quality may depend on having reliable sources, clean data that is properly authenticated, working with IT-OT and so this dependency chain must be worked out. Executive buy-in and sponsorship is critical to surviving failed pilots in sprints and sustaining through the marathon. Thus, using the right metrics, we are able to present a realistic picture to management. Since culture eats strategy for breakfast, this may not work effectively in all organizations and thus, many falter at various stages of this journey.

SMART-DATA APPROACH FOR MANUFACTURING COMPANIES, 3D TECHNOLOGY, MACHINE LEARNING, ARTIFICIAL INTELLIGENCE, AUGMENTED REALITY, PREDICTIVE MAINTENANCE AND PREDICTIVE DESIGN. IN WHICH OF THESE AREAS HAVE BEEN MADE THE MOST IMPORTANT AND MOST USEFUL STEPS FORWARD FOR DIGITAL DIGITAL MANUFACTURING? ARE THERE ALREADY ANY BEST PRACTICES?

There are 9 new technologies that impact Industry 4.0. These are: Data Science and ML, Cloud, Industrial Internet, Horizontal and Vertical System Integration, Simulation, Augmented Reality, Additive Manufacturing and Cybersecurity. Of these, one recent study showed that among large manufacturing companies:

• 85% adopted and implemented Cloud
• 65% connected sensors in their plants
• 59% connected sensors in their products
• 39% embraced additive manufacturing (3D Printing included)
• 34% deployed advanced data analytics Another survey showed the following levels of implementation:
• Cybersecurity: 65%
• Data Science and ML: 54%
• Cloud: 53%
• Additive Manufacturing: 34%
• Advanced Robotics: 32%
• Augmented Reality: 28%
• Though there are claims, the best practices are still emerging. Lessons

shared by early adopters help to a certain extent. One must seek the best practices by specific industry and vertical; then use them as a starting point or a broad guideline, not as a checklist.

WHAT IS THE IMPORTANCE OF BEING SUSTAINABLE IN DIGITAL TRANSFORMATION? Sustainability needs to be the foundation of all human activities. This is paramount to our survival. Now, digital transformation is driven by two forces: one, the set of technologies that lets you go digital and two, market forces that create such a demand.

Two vital points to remember. First, the obvious challenge facing the survival of this planet. Merely going digital has a big upside on cutting CO_2 emissions. Done right, between 2016-25, we can save about 26 billion metric tons of CO_2 emissions from three industries: electricity, logistics and automotive. Also, it is important to note that for each metric ton of CO_2 emitted by the ICT, which helps all other sectors go digital, users save 10 tons. So, the momentum to go digital should accelerate as it aids sustainability. The second vital point is nuanced and far more important. **We need to embark on digital transformation with a purpose, with a holistic approach**. We expand what sustainability truly means. We need to ensure through repeated, evidence-driven insights that the journey is progressing right. **We need to avoid complacency**. For example, merely switching to all-electric cars does not mean we have a sustainable way to producing batteries, using them and disposing them. We need to avoid system-imbalances. Digital diffusion will be slow and uneven and forging systems-level restructuring of

economies, institutions and societies will need a very careful monitoring to ensure that societal equity is preserved and that the benefits do reach all. We need to avoid over-engineering. How do we ensure that we are not over-automating systems, which can lead to over-dependence on machines and create huge cultural and societal problems by loss of jobs and livelihoods? How are we balancing the market forces with a just, ethical and moral implementation of all new advances to eradicate global climate-change, hunger and health problems? **WHAT ARE THE AREAS OF THE WORLD WHERE INNOVATION IS CATCHING UP? IS THE SILICON VALLEY STILL THE CRADLE OF INNOVATION?**

Innovation is exploding worldwide very fast. US has dropped out of the top 10 in the 2018 Bloomberg Innovation Index for the first time in the six years since this metric started. US was #1 in 2013. Here's just one example of this lack of innovation: 45% of manufacturers in the US have not yet set a specific goal for reducing new product development cycle times!

In terms of value, even though it may appear that FAANG (Facebook, Apple, Amazon, Netflix and Google) are leading the world as the most valuable brands, there's disruption ahead. Apple may be approaching the trillion-dollar mark in market cap, but innovation dependent on big companies is slow, unreliable and insufficient. **The real powerhouse for innovation are startups.** United States used to lead the world but now it's at a forty-year low. In just four years, France has gone up from 143 hot tech startups funded per year to 743 this year. More than 270

French startups flew into Las Vegas for CES 2018 and here's the interesting tidbit: France's Secretary of State for Digital Affairs Mounir Majoubi came to support them. This is just one example. Remember, US does not have a federal start-up program, while most of the emerging leaders have a blend of public, private and policy to propel startups forward.

China is blazing ahead very fast. Baidu, Alibaba, Tencent and others are achieving mind-boggling progress. Let's look at China through one lens: AI. Baidu discussed AI in its earnings call in 2010, a full five years before Google started to do so in 2015. Their advances and deployment is on an unprecedented scale. China invests more in AI startups than US does:

I don't believe Silicon Valley will remain at the helm of innovation for long. Majority of the startups are not tackling the biggest global problems.

GARTNER SAYS: "DIGITAL MANUFACTURING REQUIRES A NEW LOOK AT OLD SYSTEMS". AS THOUGHT LEADER ARE YOU AGREE?

What Gartner was referring to: The bi-modal strategy where one needs to balance Stability where manufacturing ensures a reliable, high-performance output, versus Agility in which manufacturing nimbly implements innovations bringing about changes. How to do both? That is, what to keep versus what to replace? Any change on the plant floor has repercussions for corresponding changes in processes and capabilities. There is a cost to change that is function of time. Is it worthwhile or not to do it now or at a different point in time? Could it be too late? These are the questions that challenge manufacturers.

Technology, competition and policies are changing rapidly. Manufacturing itself is going through a metamorphosis - services are now making up about 30-35% of Manufacturing employment, yet it continues to contribute disproportionately to the exports. Demand is fragmenting –more low volume orders, quick turnarounds, customized designs and orders, etc. So, this ship in sail, needs to keep sailing smoothly and replace parts and re-invent itself as it moves along. So yes, while digital manufacturing requires a new look at old systems, do not jump ships for the sake of it, prepare to start afresh and always be skeptical.

WHAT IS THE RATE OF DIFFUSION OF DIGITAL TECHNOLOGIES IN MANUFACTURING INDUSTRY (TODAY IN THE WORLD OR BY 2020)?

The rate of diffusion of digital technologies in manufacturing is slower than in other verticals and it is uneven. **Slow: Take Robotics**. About 1.8 million industrial robots are deployed worldwide today, valued at about $35 billion. Prices have fallen by about 25% over the last decade. In production, most robots are deployed in handling (packaging, picking and placing) followed by welding. Tremendous efforts are on to make robots collaborative (cobots), intuitive, self-monitoring, agile and relatable. Tesla may be a leader in adopting but most of the small and medium manufacturers do not use robots and it will take a long time for them to do so.

Uneven: Industries with higher spending on R&D had higher innovation. For example, 80% of industrial robots sold in 2015 were installed in only 5 industries, mainly automotive and electronics. More than half of 3D printing units were installed in aerospace, automotive and electronics. AI adoption started with finance, retail and healthcare – all service industries with manufacturing lagging behind. Another way is to look at the pace of change: diffusion causes disruption. So, how long does a US corporation stay in the S&P 500 Index before being disrupted? In 1958, corporations listed in the S&P 500 had an average stay of 61 years. By 1980, this average stay dropped sharply to 25 years. In 2011, it fell further to 18 years. By 2027, estimates are that three-fourths or 75% of today's S&P 500 will be replaced. Since 2000, 52 percent of the companies in Fortune 500 have either gone bankrupt, been acquired, or ceased to exist due to digital disruption.

IS THERE A NUMBER THAT COULD EXPLAIN THE VALUE OF DIGITAL

TRANSFORMATION IN TERMS OF GROWTH OR BENEFITS FOR THE COMPANIES?

When looking through the lens of Manufacturing alone:
• World Economic Forum and McKinsey have said that Industry 4.0 will create up to $3.7 trillion in value by 2025. This has secondary waves of benefits: In the US, manufacturing jobs pay at least 20% more than other service and non-manufacturing jobs [Helper, Kruger and Wial, 2012].
• Let's look at incremental digital transformation in Manufacturing: In the US, the output and productivity in firms that adopt data-driven decision making is 5 to 6% higher than expected. [Source: Brynjolfsson, Hitt and Kim, 2011]. Among industrial adopters, IoT reduces costs by 18% on average [Source: Vodafone, 2015].

In the aviation industry, for example, 1%increase in the maintenance efficiency can save about USD 2 billion annually globally. [Source: Evans and Anninziata, 2012]. Autonomous mileage trucks could increase output by 15-20%, reduce fuel consumption by 10-15% and reduce maintenance costs by 8% [Source: Citigroup-Oxford Martin School, 2015].

SBeyond Manufacturing, a 2015 BCG report estimated that the digital economy would contribute $4 trillion to the GDP of countries in the G-20 during 2016 and continue to grow at 10 percent per year. More important, **digital economy is a catalyst for social and political change**.

One should to be cautious about the hype around all of this. There's hype in media, from marketers, from rivals. It takes a lot of time/resources to dive into any claim to verify its veracity. Humans have always understood that the real value is in the intangibles.

From Adam Smith through Marx, Keynes, Friedman and Piketty, we have tried to assess the value of these intangibles by assigning a number. While one understands the purpose behind this, one must also be very careful not to let this degenerate into a meaningless number. So, beyond numbers, there is still a tremendous value coming from Digital Transformation.