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A Future Curriculum for the University of Birmingham

Problem: Students are university products, destined to industries that run a knowledge economy of any country. The technological disruptions, e.g. additive manufacturing, collaborative robots, ICT revolution, industry 4.0, internet of things, will reshape future industrial organizations' structures, business models and operations. In Japan, human resource on the production line was replaced completely by robots that resulted in a 250% increase in productivity and <1% faulty products. Recently, Boing and Airbus partially converted their assembly line into a semi-robotic line to address increasing backlog due to quality related issues. To understand how robot replacement will happen, the following quadrants break down our relationship with robots into four categories:
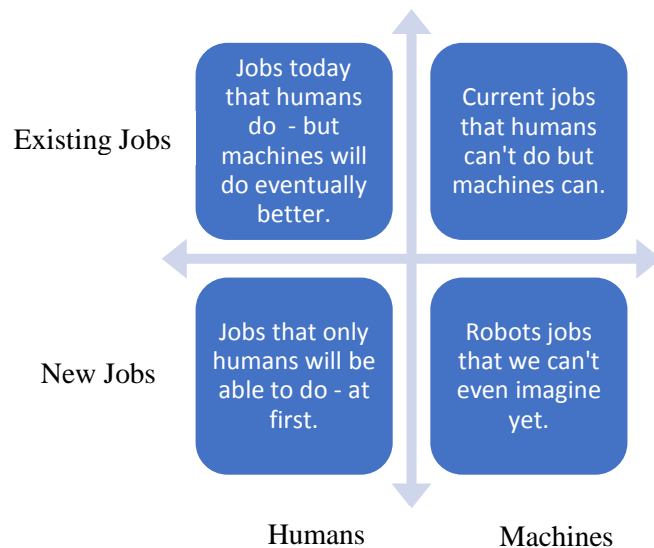
Moreover, a recent revolution in ICT technologies has enabled horizontal and vertical integration across production lines with industry 4.0 and IoT for competitiveness. Consequently, industrial needs and expectations from university graduates will change as human focus will shift towards right decisions at the right time in collaborative robotic environments, with industry 4.0, IoT and ICT based revolutions connected to supply chains. This requires universities to react proactively, by restructuring their academic operations, to ensure sustainable economic growth through quality assurance in products, i.e. future students.

Solution: The proposed changes, for future universities, should be at three levels: delivery methods, course content and centers of excellence.

a) **Delivery Methods:** Virtual classrooms, MOOCs (massive open online course) and virtual reality should be employed for delivering course content. The virtual class room would eliminate the need for students and professors to be physically present on-campus. Moreover, robots must replace teaching professors. This would allow academic faculty to shift focus on industry centric research so that, in partnership with the industrial sectors, they can work to achieve excellence through applied industrial research on innovative

and disruptive technologies for competitiveness. The virtual classroom would help in reducing the carbon footprint, resulting in more GREEN universities. Besides MOOCs, the VR technology would be employed to train university students practically, in collaborative robotic environments in the most efficient and effective ways prior to entering a highly competitive real environment.

b) **Course Contents:** In the era of 'Big Data', challenges in future industries would involve the ability to make right decisions at the right time, exploiting data resulting from the industrial shift towards industry 4.0, IoT and ICT revolutions. The course content must, therefore, be structured and all disciplines offered at the university should consider:

- homogenizing a variety of data: sensors temporal data, text/csv data (unstructured data), databases and data warehouses (structured data), contextual data, images, videos, pdf etc. with the ability to produce information and best visualization to support decision making;
- knowledge (predictive) modelling, to support decisions as a second opinion, because transformed information analysis could easily result in paralysis;
- inclusion of industrial case studies;
- provision of tools and techniques training to generate information;
- data visualization techniques, so that everyone can reach the same decision and information would not require cognitive processing to infer decisions from it.

c) **Structural Change (Centers of Excellence):** Universities will be working with industries as partners to help them in their competitiveness, through innovative and more targeted applied industrial research. As teaching staff will be replaced by ROBOT teachers faculty will work more closely with industrial sectors to not only produce scientific contributions, based on simulated data and sensitivity analysis, but on proof of concepts by their validation with industrial data. Further, these centers of excellence have to emerge with a business model where they can engage SME's to expedite the commercialization of research based proof of concepts. This will help universities to sustain their financial autonomy even when we shift to virtual campuses or virtual teaching business models.

Conclusion: This suggested change in curriculum is not a race against the machines. This is a race with the machines. If we race against them, we lose. In future, 90 percent of our coworkers will be unseen machines. Most of what we do will not be possible without them. There will be a blurry line between what we do and what they do. Hence, let the robots take the jobs, and let them help us dream up a new world that matters. This all will be possible if we adapt changes so that we are able to compete with new emerging technology.