



Research Paper

The Modern Production Process Economic Impact of Information Technology

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Received 12 February, 2014; Accepted 25 February, 2014 © The author(s) 2014. Published with open access at www.questjournals.org

I. INTRODUCTION:

Will the “Factories” as we know them, become extinct with the application of advanced Information Technology?

Sounds like a rhetorical question. Doesn't it?

And I also know that this is not going to happen in a hurry. But before we dismiss the thought let's have a look at the way things are shaping up.

The Conventional factory – Characteristics

In the context of our topic of discussion, here are some rather simple and fundamental characteristics of the factory as we know:

1. **Dedicated Production Facility** – More often than not, a factory is owned by a given business and is used to manufacture parts and wares of a given design and usage over the long run.
2. **Rigid Product Mix** – The factories are built to produce a certain limited variety of products. The assembly lines are flexible enough to tweak the Product-Mix in accordance with the market realities and resource availability. But nothing beyond that. Adding a new product to the factory involves a lot of expensive and time consuming changes. Result is that the product mix tends to be rather sticky.
3. **Strength in Continuity** – A factory has many reasons to continue producing whatever they have been producing. A certain knowledge base on best practices and past experiences gets built up – in the mind of the workers and the management. Please note that all this is stored in the mind of the workers and not accessible to anyone else, least from any other location.
4. **Prime-Shift Operations** – Many factories work only single shift. Multiple reasons - worker ownership of a work-station, lack of means of properly measuring machine-fatigue, shortage of skilled human resources and most of all absence of market pull for additional production often contribute to this sub-optimal-by-design for return on capital invested.

Why should it bother anyone

Well.... What's the big deal here? The factories have worked like this and have worked in this manner through all the phases of the industrial revolution. Seems to work fine. Why worry?

The prime issue here is of sub-optimality. The whole idea of mechanization and of building the factories was optimization in the utilization of resources like labour, material and capital. And through the phases the factories have continued to do a fine job of it by constantly evolving and reinventing themselves.

When we look around ourselves, we find that business organization dynamics are changing at an ever faster rate. Intense competition in the market leads to enhanced speed of innovation and this makes for ever shorter product life cycles. The consequent impact on the productive life of a factory designed to produce a definite set of products is there for anyone for see. If the productive life cycle of a factory is going to be shortened, the economics of the return on capital invested is certainly going to be impacted.

Enhanced rate of obsolescence of the dedicated machinery means a sub-optimal utilization of the precious and dwindling natural resources. It is something that our ecosystems can ill afford.

Higher obsolescence rate of these machines also creates problem of disposal, having serious environmental ramifications.

Under-utilization of the capital invested leads to diminished profit margins, thereby blocking financial resources which could have been utilized for welfare of labour, higher taxes for the government to invest in public services, and restoration of our environment.

So...What's new

As with earlier revolutions, the Industry 4.0 is causing an entire paradigm shift in the concept of a production facility. Let's examine the implication of some of these developments:

1. **Computer Integrated Manufacturing** – Increasingly, the entire set of communication/information exchange between the sub parts of production operations, right from requirement assessment, design specs and production design, actual production, usage support & feedback, and disposal tracking is happening thru an Infotech backbone. This is quite different from the conventional throw-over-the-wall approach. In our context, this means that all these departments can still work together in the most optimal manner even if they are not based at the same location. It no longer call for all the people involved in design, production and support of a product to be long term parts of the same team. Therefore it is no longer needed for all of them to be employees of the same organization. Is there, therefore, a need for a permanent dedicated set up for design, development, and support within the same organizations? I doubt that very much.
2. **Digital Data Repository** – All the data related to a given product/lot is stored at one place. This would include the requirements inventory, the design details, the production environment details, the design deviations, the QC feedback and the user feedback. Anyone with a suitable authorization to access this data repository can work equally well on design improvements, production environment optimization, support or disposal. To me, this means a shift towards the need of engineering experts who can make sense of out this vast amount of data. A shift away from a set of people who have been dedicatedly working on this one product. Again, aren't we moving towards outsourcing rather than having dedicated facilities?
3. **Intelligent Machines** – The intelligent machines started making a foray into the factories as early as 1960's. Today's Intelligent Machines are not merely designed to take care of manufacturing parts, or products based on a design fed by a computer. They actually go about doing their work while keeping track of the quality of output, the utilization of raw material and even their own health. They are very nimble as far as manufacturing based on a new design goes, or making some minor modifications to the design of an existing product. As an example, car factories are acquiring the ability to build cars with customized features. They say they can make each unit as a unique peace. By one small extension, can't the same factory at some stage produce multiple brands of cars?
4. **Cloud Computing** – And while we are at all of the above, the cloud computing infra gives a very convenient and cost effective way to access all the data, information and instructions from any location. So the people/teams collaborating on some work need not even be co-located.
5. **Advanced Analytics and Machine Learning** – These two are the modern technology boons to the industry. Computers are not merely capable of making business sense out of the wide variety and high volume data, they can even be programmed to detect new variables in the game and keep assimilating those variables into the analysis, all by themselves. Very soon they would be in a position to understand the meaning of negative buzz around the quality of a given product on the social media and couple this with the understanding of engineering science to suggest design modifications.
6. **3D Printing** – It increasingly possible to produce any tool, part or die using 3D Printing Technology. This enables a given factory to start producing a new item or a product very conveniently and very fast.

II. CONCLUSION

There was a time when publishing houses needed to have their own printing facilities. For this reason some of the most reputed publishers of the world have the word "Press" as part of their name. For similar reasons a large section of print journalists still call themselves "The Press"!

Very soon it was realized that, in order to produce a quality book, you did not need to own a printing press and that the printing facilities could be shared among all the consumers of such services. Today, as we know, very few publishing houses own printing facilities as part of publishing business.

For various reasons the same was not applied to the manufacturing industry at large. Factories continued to be dedicated to the given product/brand.

In the current era where the need for optimality is higher than ever, where all premises are being question and demolished, where technology is providing convenient means to do things differently – we can even the question the continuation of factories as we know today.

In my view, it is possible that the smart factories of the future would be capable of productionizing articles in much smaller lots based on highly customized designs. The product mix would be very flexible and supported by the digital 4.0 advances these factories would be capable of changing over from one product type to another, almost seamlessly. They would be able to work with different materials and be able to produce output in varying qualities and incur costs accordingly.

Till the next revolution, some form of specialization would be retained. A car factory would be a car factory, a phone factory would be a phone factory and so on. But they would not be constrained by the size,

shape, material used or the form factor of the end product. The same factory could be producing Mercedes Cars in the morning shift and Suzuki in the evening, each as per the design and specifications of the brand owner. For all you know, the same assembly line may have different models/brand interspersed with each other in the same shift.

This could set in a new era of completely outsourced manufacturing and this could be as impactful to manufacturing as Uber is to Taxi or Airbnb is to short term accommodation booking. Ownership of factories would become independent of business ownership. Businesses or brands would primarily own a whole lot of intellectual property, developed using outsourced facilities. Production would be outsourced to smart factories. Customer support organizations, capable of supporting multiple brands would work independently. All these organizations would be bonded together by the ubiquitous Digital Thread.

CITATIONS

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