Induction of Cross-Functional Department to avoid Design Mis-match

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Abstract- The broad areas covered by this Research paper is as follows:

1. Product design & development
2. Sustainable Manufacturing
3. Environment Management system
4. Waste Management
5. Performance analysis
6. Optimization techniques

According to Wikipedia, design can be defined as "a plan or specification for the construction of an object or system or for the implementation of an activity or process, or the result of that plan or specification in the form of a prototype, product or process"

Similarly, "Design thinking refers to the cognitive, strategic and practical processes by which design concepts (proposals for new products, buildings, machines, etc.) are developed. Many of the key concepts and aspects of design thinking have been identified through studies, across different design domains, of design cognition and design activity in both laboratory and natural contexts.

Design thinking is also associated with prescriptions for the innovation of products and services within business and social contexts. Some of these prescriptions have been criticized for oversimplifying the design process and trivializing the role of technical knowledge and skills"

In this context, design is major aspect of any products life-cycle, its positioning in the market and the possible performance with which it will endure its desired function.

Easier said than done, it is not always possible to map out the exact design of a product or component and there can be deviations due to various factors. Without going deep into the restrictive factors of a design, the paper tries to cover the aspect as to how a multi-functional approach can be used to maximize the usage & functionality of a product, decreasing a company's third-party reliance while achieving end-user compliance.

A case study is also included to understand how even companies functioning at the top of the pyramid are still susceptible to design mismatch where two or more products released in market in succession, fail to interact with each other.

Possible approach to overcome these set of problems are explored along with learning while taking note of missed opportunities and the effect of such design flaws on environment are briefly understood.

Keywords: Product life cycle, Lightning Port, Environment Compliance Product, Design Thinking, Agile, Lean Manufacturing.

Literature review- Design mis-match can be broadly & in this context can be defined as the failure of interaction of two or more products to achieve desired functionality along with increase in user confusion while also increasing impact on the surrounding environment.

A product design is of prime importance for every company. Its importance keeps increasing depending on whether the product is to be interacted by a customer or an industry. The design can also be linked to the overall aesthetics of the product which can be the deciding factor of purchase of a customer.

A quote from one of the biggest entrepreneurs of the century Bill Gates is as follows:

"If you can't make it good, at least make it look good"

It carefully emphasizes on the fact that design and aesthetics of a product can very well predict its future growth & market position along with product life cycle (PLC).

Case study- It can be observed in one of the biggest companies in the world Apple Inc. where they removed the headphone jack from their iPhone line-up to make space for other key components, which was partly true but one of the other major factors was Apple diversifying its cash inflows using their patent technologies.

Most end users are not aware of Apple's patents as that when a third-party company wants to design a headphone, earphone or any other component which is intended to be paired or used in conjunction with an iPhone it needs to pay some amount in fees to Apple to make it compatible.

Apple also collaborates with some premier market leaders to design cases, earphones which it sells on its official website.

In the headphone case, Apple makes huge revenues since companies designing earphones have two routes to opt, either to use the wireless technology and pair with iPhone using Bluetooth or go the wired way and use the thunderbolt port present on the iPhone which also serves as the charging port for the iPhone.

In either case, the manufacturer needs to use Apple compliant-technology to be compatible with their iPhones & other Apple devices.

The removal of headphone jack was also a step into the future for Apple to introduce a new product called EarPods which are Apple's official version of wireless earphones. 60 Million units of EarPods have now been sold by Apple in 2019, which created a huge inflow of cash ($6 Billion) and also diversifying their cash inflows.

Apple is one of the market-leader in USA in smartphones which is its core area but even after becoming a trillion-dollar company it suffers from portfolio diversification, iPhone still accounts for more than 50% of cash revenue generation and even after continuous efforts Apple has failed to achieve iPhone

like success in any other product. Arguably MacBook's are a generally preferred product by students in USA but its restrictive nature and poor compatibility of software's with other operating systems makes it niche product in markets like India & Asia.

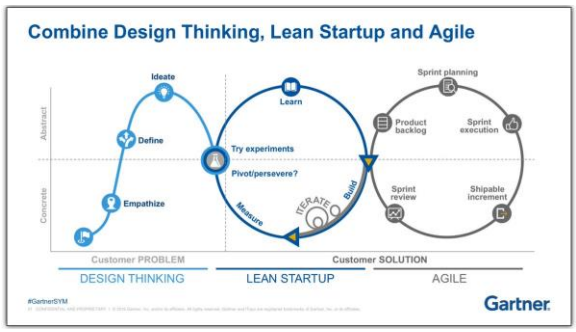
Coming back to mis-match in design by Apple, the headphone jack is present in their MacBook lineup of laptops but is missing in iPhone. The iPhone 7 and all future models have no headphone port. Instead, it has a Lightning port, so Apple made headphones that plug into a Lightning port. The MacBook Pro, meanwhile, has a headphone port, but it has no lightning port.

Apple makes a dongle that allows normal headphones plug into a Lightning port. Unfortunately, Apple does not make its reverse: an adapter to plug Lightning headphones into a headphone port.

This is a huge design flaw where 2 products of the same company released in succession cannot interact with each other. It also creates a state-of-confusion for the end user & makes them carry an extra pair of earphones one with a lightning port and the other with a 3.5mm headphone jack.

Methodology: The most important aspect here besides user confusion is the impact of such product on the environment. Below is the mentioned process layout in the form of flow chart to better understand & simplify a product design process.

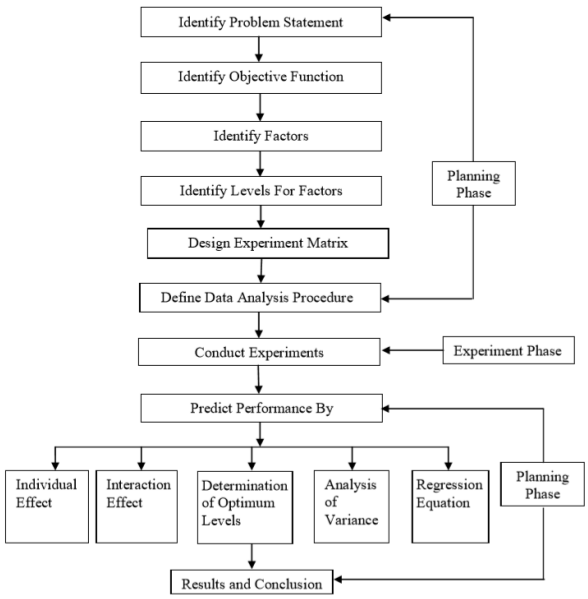
The 6/60 rule of product testing: Product testing and designing can be done in numerous ways but an approach that is tested in the real world tends to ensure that product is functioning as intended. The 6/60 rule of testing does the same in which a prototype of product to 2 specimens one being 60+ years old & the other around 6 years old. A mass intended product should be designed such that it can cater to both the ends of the spectrum.



Design Thinking + Lean + Agile- Agile is a widely used product development process but comes with its own shortcomings therefore research is being done to incorporate Design Thinking with Agile but at the same time inducting a 3rd methodology with forms the core of Agile: Lean Methodology.

Design thinking focuses on the why of product design while Agile methods ask the question of how of product design by disseminating the work flow in smaller units. The lean start-up is model of helping convert needs of consumers into business models.

Flow Chart for Design of Experiment



Environment Compliance Product (ECP)- As there is a global outbreak on the amount being generated each day, it has become the hour-of-necessity for every industry to manufacture in a way that its products have least effect on the environment.

Recycling of waste & scrap generation from by-products is also to be taken into consideration right from the onset of plant layout of the industry.

Empirical results- In an attempt to reduce manufacturing assembly time & to increase department communication at Volvo-Eicher Commercial Vehicles, located at Pithampur, where I worked with the Manufacturing Engineering department, I was looking after the vehicles that were assembled & finalised on the Low Duty (LD) line.

To overcome the general mindset of the worker on the line is that the vehicle passes through his station and not be bothered about the difficulties faced by the next station due to direct or in-direct not up to the mark performance done by the worker. This led to huge delays in the completion of a vehicle and getting it tested and passed was delaying the whole cycle time.

To overcome the problem a person from following departments are made present-

1. Quality assurance
2. Vehicle inspection
3. Electrical harness

The worker can be rectified in real-time during the assembly being done on the line. Person from design and R&D visits the assembly line frequently to check what future revisions can be done to decrease the cycle time of assembly.

Furthermore, a real-time line simulator software is in R&D using which except for the worker doing assembly on the line the rest of the employees of various departments will be able to track progress on their workstation remotely.

Implications in practice- Simplification of component design & decrease in the product cycle time is one the major reasons for designing a better product.

Environmental impact is considerably reduced along with less generation of scrap & improved recyclability.

Cross-functional interaction of departments allows for a more coherent design process which is not only better in aesthetics and user functionality but also allows for faster production.

Study on all possible factors are currently being explored and improvement will be updated as & when found.

References: 1. Galbraith JR (1977) Organization design. Addison Wesley Publishing Company

2. Shingo S, Dillon AP (1989) A study of the Toyota production system: from an industrial

engineering viewpoint. CRC Press

3. Monden Y (1983) Toyota production system. An integrated approach to just-in-time

4. Ohno T (1988) Toyota production system: beyond large-scale production. CRC Press

5. Becker RM (1998) Lean manufacturing and the Toyota production system. Encyclopaedia of

world biography

6. Jaiswal P, Kumar A (2016) Analysing barriers of lean manufacturing adoption in Indian SMEs

using an integrated approach of grey decision-making trial and evaluation laboratory (DEMATEL). In: World congress on engineering, pp 688–691

7. Anvari A, Ismail Y, Hojjati SMH (2011) A study on total quality management and lean manufacturing: through lean thinking approach. World Appl Sci J 12(9):1585–1596

8. Kainuma Y, Tawara N (2006) A multiple attribute utility theory approach to lean and green

supply chain management. Int J Prod Econ 101(1):99–108

9. Bergmiller GG (2006) Lean manufacturers transcendence to green manufacturing: correlating

the diffusion of lean and green manufacturing systems

10. Singh BK, Bhar C, Pandurangan V (2011) Competitive advantage of lean manufacturing over traditional manufacturing. In: Proceedings of the international conference on industrial engineering held at SVNIT, Surat, 17–19 Nov 2011, pp 442–446

11. Parras, L., Ferrera, C., del Pino, C., Mäkelä, T. & Bello-Millán, F. J. Experimental study on Ahmed's body drag coefcient for different yaw angles. J. Wind Eng. Ind. Aerodyn. 157, 140–144 (2016).

12. Tunay, T., Sahin, B. & Ozbolat, V. Efects of rear slant angles on the flow characteristics of Ahmed body. Exp. Term. Fluid Sci. 57, 165–176 (2014).

13. Spohn, A. & Gilliéron, P. Flow separations generated by a simplified geometry of an automotive vehicle. IUTAM Symp.unsteady separated flows 1–6 (2002).

14. Meile, W., Brenn, G., Reppenhagen, A., Lechner, B. & Fuchs, A. Experiments and numerical simulations on the aerodynamics of the ahmed body. CFD Lett. 3, 32–38 (2011).

15. Rakibul Hassan, S. M., Islam, T., Ali, M. & Islam, M. Q. Numerical study on aerodynamic drag reduction of racing cars. Procedia Eng. 90, 308–313 (2014).