Car: A Drama of the American Workplace

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This book chronicles in great detail the design and manufacturing of the 1996 Ford Taurus. This was a critical event for Ford. The Taurus is their most important product. It sells in high numbers and underpins the entire car business for the company. Overall the book is an inside look at the fascinatingly complex process that is creating a new vehicle. It includes all aspects of design and manufacturing rather than a single topic.

Manufacturing

Depending on trim level and options, a modern car contains on the order of 30,000 parts (http://www2.toyota.co.jp/en/kids/faq/entry/6203.php). Depending on the company, it takes 3-5 years to go from drawing board to manufacturing a car model. For this particular car, Ford assigned 700 engineers and related staff. Total investment was around 3 billion dollars just for designing the car. For all of these big numbers, the basic layout was not changed and the engines were not included in this redesign. The scope of the project is mind boggling, and in the end it revolves entirely around manufacturing. Each one of those 30,000 parts has to be made somehow. To make a profit selling a $20,000 object that cost $3 billion to design requires mass production, so those 30,000 parts have to be mass produced fast, cheaply, and on a huge scale.

Because these parts are made in such huge numbers, cost is a driving force in design. Designing purely for functionality is not possible. Instead, the part must be designed to be cheap and easy to manufacture. Budgets for parts are down to the penny. For instance, a part costing 32 cents above budget, spread out over 300,000 vehicles sold in a year, costs Ford nearly $100,000 in lost profits. This is mentioned time and again in the story of the Taurus’s design.

This book covers extensively the engineering process involved in a new car model, but from the very beginning it is obvious how the car must be designed for manufacture in a large scale as well as part by part. When first discussing the new model, the very first constraint was that the floorpans must not move further away from each other in width so that the car could use the same robots on the assembly line as the old model (pg. 29). Changing the robots, or retooling the assembly plant, costs millions of dollars, limiting the design freedom of the engineers and stylists.

The people responsible for designing the exterior of the car, or “stylists” (pg. 25), were the first people to make progress on the new Taurus model. The exterior must be done first, at least in rough form, because it dictates how much room there is inside. For instance, fitting the various systems under the hood, like the engine, drivetrain, air conditioning, heater, cooling system, and on and on all depends on how big the hood is. Cars are a victim of our post-scarcity economy in that they are easier to make than sell, and therefore must be sold based on style. This period in automotive history marked the height of the transition from the boxy cars of the 1980s to the rounded, curved cars of the 1990s and 2000s. Those curves were the style that would sell the car; however they were also had to be manufactured. A big exterior compromise was what looked attractive verse what was possible to stamp. Also at play was how accurately the pieces could be stamped with relation to one another. Complicated, complex body panels tend to not line up with each other when they are actually bolted to the car (pg 36). During this phase of engineering, the most effective way to model future problems and decide what was actually possible was to simply have an experienced worker used to stamping and assembling come in and look at the clay models.

Quality

Manufacturing is more than just cranking out parts, and as such it played a larger role in design than just finding out what was possible to make and what was not. The quality of the final product also must influence every decision, beginning with the very top person involved. If style sells a car, its quality sells the next model of it to the same person. As such, the 1996 Taurus broke new ground at Ford in terms of designing for quality. Dick Langraff headed the team in charge of the car, and made it so that the engineers actually did work as a team. Typical practice at Ford was to have the chassis team design the chassis from their fiefdom while the powertrain team designed the powertrain from their building, all without ever interacting with each other in a meaningful way. This was the opposite of the Japanese system that emphasized teams built around the objective rather than the individual specialty. While Japanese quality had skyrocketed over time, Ford’s had stagnated and fallen behind the industry leaders. This was remedied in part by having each person work toward building a car, rather than a component. Managerial changes throughout the company were happening at the same time in pursuit of higher quality products. Ford hired many consultants to try and find out how to compete with the Japanese, including W. Edwards Deming. Perhaps the best quote in the book is from him: “Export everything to a friendly company except American management,” (pg 88). He advocated the same principals of removing “organizational chimneys” and “management through conflict,” that the Taurus team was working to overcome. Less successful methods of quality improvement through management improvement were attempted as well, including such inane things as personality tests. Dick Langraff mixed teamwork with a leadership approach that included constant follow ups and pressure to perform.

Quality begins at the very top, but it also has to go all the way to the very bottom. The 15 mile long line at the assembly plant chose for the Taurus in Atlanta, Georgia had a strong focus on quality. The focus did not come easily or cheaply. Automotive plants tend to operate beyond capacity or furlough, depending on the cyclic swings of the automotive industry. It is a difficult reality for the workers because it is undependable employment. The only way for a line worker to combat the uncertainty is to construct a car so well that it will still sell in down times based on its quality. The plant learned that the hard way in 1979 when an entire shift was laid off for 5 years. People lost jobs, homes, and families. From that time forward foolish antics and a lack of work ethic were no longer tolerated in the plant by the managers. Workers focused on quality and took pride in their work. Moral increased, as did quality. Workers were invited into the management of the plant by joining the operating committee. “…He was amazed to see how much it costs to run an assembly plant. Now the union campaigned to hoard stock and energy. ‘It’s money in the profit-sharing check.’ By 1992 Atlanta was one of the country’s most efficient plants.” (pg 285). The workers had learned the “sobering consequences of slapdash assembly and customer abuse,” (pg 285).

Quality must be worked into management, assembly, and design. Many of the parts in a car are manufactured by suppliers rather than car companies, hence the term “Assembly Plant.” The quality of the car is only as good as the components in it. Ford used two forms of suppliers, internal and external. The internal suppliers were owned by Ford but operated as separate companies that the Taurus team “bought” parts from. However, because the supplier was owned by Ford it had no competition and therefore no incentive to manufacture high quality parts to keep its supplier status. The external suppliers were notorious for failing to deliver on promises about cost, and quantity, and the parts delivered were often of low quality. Since it takes years to design parts, Ford could not simply get the parts from someone else, forcing them to find a non ideal solution to quality problems. Many of the companies had difficulties accomplishing the demanding Just-In-Time manufacturing method utilized by Ford and described in the book. The seat manufacturer, Lear, is on example of the benefits of the system as well as all the things that can go wrong for a supplier attempting it (pg 198). It committed to providing seats that were well beyond its capabilities and Ford suffered from having to resolve the situation later on.

Business

As explained above, creating a vehicle involves numerous business decisions. The basic business concepts of time and money make all the decisions involved in producing a car. Ford is a business, and the Taurus team was in a way a smaller company in and of itself. They had to design, build, and most importantly sell a car for a profit. Therefore, the new car was constrained by the size of the existing manufacturing line’s robots. The cost of each part was required to fall within a budget that was down to the penny. The assembly workers had to put things together well to ensure the car would sell. The engineers played second fiddle to the stylists in terms of importance, because stylish cars sell better than well engineered boring ones. Poor quality costs money, so high quality was emphasized from the very top on down to the very last worker. Manufacturing is part of business, and therefore must be done with business principles in mind.

Relevance

The significance of this book for a beginning engineer lies in its honest discussion of an enormous, real-life engineering project. It does not gloss over the personality disputes, friction, or importance of working on a team. It honestly portrays how consuming a project can be, and the personal cost an engineer pays to be a part of it. Engineering classes do not give any warning about this, or give any help on how to deal with it. In terms of manufacturing, this book shows rather than states why it is important to design for manufacture. It is one single, 346 page example of every concept mentioned in class played out on a huge scale, from Demings ideas to material handling.

The significance of this topic for an experienced engineer is getting an objective look at engineering. In the same way an editor is necessary to produce high quality literature, this is an outsider looking in and exposing mistakes that one might be too close to see. It offers a simultaneous glimpse of both seasoned and fresh engineers, with each point of view explained. It also shows the interaction between the senior engineers running the production project interacting with the non-engineering plant workers, and what each of them dislikes about the other. For instance, the fact that some line workers resent engineers or management wearing ties is something that would be difficult to find out, but very useful to know. It also shows which management styles are appreciated by workers and which are counter-productive.

Knowledge Gained

Reading *Car* and writing about it taught me how the classes I have taken apply to real life. As stated in the relevance section, the book is a comprehensive example of life as an engineer. The book begins with the very earliest stages of gathering a team and making a schedule and continues all the way into the show room where salesmen try and move the product. Along the way I learned far too many things to be listed, covering topics from work by committee to data gathering to what truly motivates a design. While this book is not a page turning thriller, it should be required reading for every engineering freshman.

Reference

Walton, Mary. *Car: A Drama of the American Workplace.* New York: W. W. Norton and Company, Inc. 1997, Print

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