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Reforming the Product Variant Codification to Support a Holistic Perception of Product and Work Processes in Motor Vehicle Assembly

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1. PRODUCT VARIANT CODIFICATION SCHEME

In the automobile industry product variant codification schemes are used for such purposes as materials control, quality assurance and assembly instruction [1].

Complete automobiles and its product variants are generally specified by using a Product number containing 20-35 characters. This number is basically market oriented and commonly used in design department, process engineering department and in different final assembly plants. The charters in the Product number are divided into positions. Each position corresponds to the choice of the components required. Because of the complete automobile comprise a combinations of components, both excluding each other or added as options.

In the design oriented scheme product variants are specified by selections of approximately 1 000 possible vehicle properties, in this context called Variant designations. These variant designations are divided into approximately 200 property classes, in this context called Variant families. Approximately 200 Variant designations are required to specify a typical automobile. Actually the Product number generates a number of Variant designations which are combined to Material control codes (500 for a single automobile) and thereby specifying the components.

We have studied two final assembly plants, designated A and B. Plant A has traditional serial flow using an assembly line, 2 minutes cycle time. Plant B on the other hand, has a parallelliezed flow and autonomous groups with long cycle time, minimum 1.5 hours cycle time.

Depending on the assembly principles but also on the local process and conditions, each different final assembly plant in practice uses it's own locally designed Variant specifications, i.e. the form describing the product variant.

The Variant specifications in final assembly plant A describes product variants through totally 750 different possible vehicle properties ("Variant codes"). One typical automobile requires 125 codes. The Variant codes corresponds to totally 160 different property classes ("Variant groups") and consists of one or two characters. These groups do describe some sort of

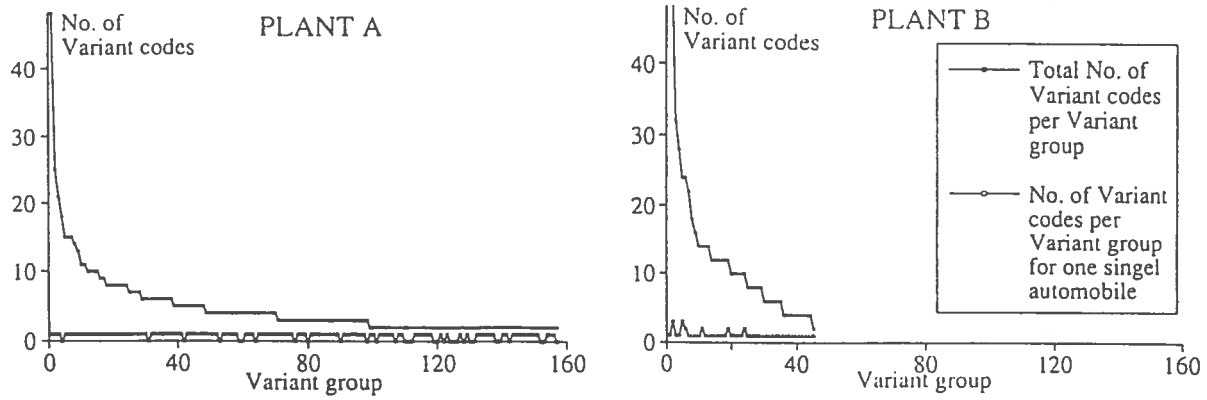

Figure 1. The vehicle properties and property classes used in the Variant specifications of two different final assembly plants.

characteristic of the automobile. The Variant specifications are arranged according to how the assembly was organised 15 years ago. Since this time both the product and the assembly process have changed radically, resulting in a Variant specification which is badly arranged and difficult to interpret. Note that this is not a matter of great significance since the assembly work is short cycle time. The purpose of the Variant specification is close to that of a picking list in this case.

The Variant specification in final assembly plant B, on the other hand, is reformed according to the automobiles inherent structures. The reason for this reformation is due to support a holistic learning needed for the extreme cycle time.

As noted in figure 1, the number of Variant codes required for specifying the automobile in plant B are less than the one needed in A. In plant B one typical automobile can be described through using only 45 Variant groups and only 50 Variant codes even though the total number of Variant codes are 560.

2. PRODUCT VARIANTS AND ASSEMBLY WORK IN ASSEMBLY PLANT B

To illustrate how the product variants influence the assembly work, we have in figure 2 arranged the Variant groups and Variant codes according to the work pattern of nine workers in the autonomous groups used in plant B. Note that only 26 of the 45 variant groups does influence the execution of the assembly work. The choice of interior colour does not effect the assembly work.

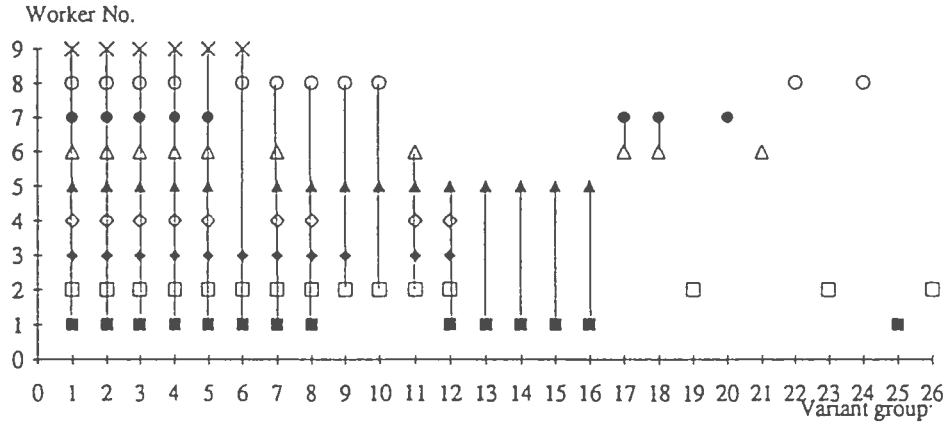

Figure 2. The product variants influence on the assembly work in plant B for all product variants produced. Each worker are coded by symbol and figure. Worker 2-9 are working in pairs.

3. CONCLUSIONS AND IMPLICATIONS

To conclude, reformation of the Variant codification scheme implies a far less complex product from assembly point of view, than the traditional scheme implies.

Since all automobiles inherently display generic characteristics it is possible achieve an holistic perception of the product using only a few property classes. As figure 2 shows, the Variant specification in Plant B just call for about ten Variant groups to specify the majority of the assembly work.

This knowledge therefore, makes it possible to use a non traditional scheduling and planning of product variants - a less need for detailed sequencing, because individual automobiles could be arranged according to if Variant codes are influencing the assembly work or not.

4. REFERENCES

1 T. Engström, D. Jonsson and L. Medbo L (1993). An Assembly-Oriented Product Description System as a Precondition for Efficient Manufacturing with Long Cycle Time Work. Fourth International Conference on Productivity & Quality Research (ICPQR-'93). Miami.