

# PROCESS EFFICIENCY AND DESIGN REWORK AT EARLY STAGES OF THE VEHICLE PRODUCT LIFE CYCLE

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## I. EXECUTIVE SUMMARY

The industry knows all too well that from concept to launch, the total product development process must take less time, consume fewer resources, and be more responsive to changes in the economy, the market, regulation, and technology. This is the core challenge that automotive executives, designers, and engineers live with every day of their working lives. Key to meeting this challenge are many trade-off decisions that must be made early in the concept development phase of the life cycle, and which are critical to the unfolding, and ultimate success, of a vehicle program. The industry must make these decisions based on more, and more certain, knowledge and must employ that knowledge in shorter decision cycles. Better information and shorter cycle times will decrease the need for costly and time consuming revisions at later stages. Also, because unpredictable changes will always exist, shorter decision times are needed to assure powerful responses to unforeseeable events.

Despite the importance of these early stage processes, there is little systematic knowledge about how early-stage vehicle design actually takes place in the automotive industry, what the problems are, and how companies are dealing with those problems. This project was an effort to provide that systematic knowledge. We detailed nine cases where manufacturers had significant trade-off decisions to make in the concept development phase of the vehicle product development. Five common themes emerged from these cases: 1) foreknowledge of consequences, 2) reasonableness of decisions, 3) business outcomes, 4) the quality and quantity of available information, and 5) the source of rework.

Based on these cases and their commonalities, we sketched respondents' diagnoses of early-stage problems and the solutions they are attempting. It is certainly the case that respondents were more concerned with organizational and human resource approaches to improving high-level design, than with a software-tool oriented technological approach. We base this conclusion not only on the content of responses, but on the amount of time and attention given to organizational, as opposed to technological, issues. At several instances during each interview we made a point of pushing the discussion in the direction of tools. However, the respondents continually came back to two organizational themes: first, establishing rich, cross-functional interaction with shorter feedback loops among the layers of management; and, second, populating these new systems with a relatively small number of very experienced people. There was a clear sense that personal expertise was vital and that the key to success was bringing that expertise to bear in an effective manner.

With respect to software tools, we found our interviewees focused on: 1) function-specific tools, 2) integration tools, and 3) history of success and failure. With respect to function-specific tools, some new functionality is needed in the form of better parts databases, but the main use of tools is within specific functional areas. As for integration tools, two types of functionality can be discerned: the ability to organize and cross reference diverse information and the ability to analyze dependencies. With respect to organization and cross-referencing, there is a desire for better tools, and effort is being put into acquiring that functionality. In terms of analysis of dependencies, however, there is more ambivalence. On the one hand, the industry is putting effort into development. On the other hand, similar effort has failed in the past and people are skeptical. The explanation for past unsatisfactory performance is that too many unknowables had to be factored into algorithms, thus, leading to a reliance on uncertain assumptions.