

Research on Software Product R&D Mode Based on New Function Development



Yun-lin Ma, Dong-ping He, Xiu-quan Tan, and Ju-gang He

Abstract This paper takes the research and development model of a company's core component software products (new function development) as the research object, through the entire project from the pre-research to mass production stage, and successfully entered the B-sample development stage with the support of partners, and proposed A brand-new software technology research and development model was created, which creatively proposed four points for integration with the mass production product development process, and it worked well in the pilot project. This model fully guarantees the achievement of project objectives, provides a specific implementation path for the organization's pre-research and mass production product development models, and also provides a new methodology for software product development with new technology development.

Keywords New functions · Pre-research stage · Mass production stage · New methodology

With the continuous acceleration of economic globalization, modern enterprises are facing increasingly fierce competition, especially in the automotive industry. Reducing engineering design and product costs, improving product quality, and shortening product cycles have become the core factors for the survival and development of today's Chinese auto companies [1]. The development of automotive software is also facing the same dilemma. Along with the "new four modernization" trends of electrification, intelligence, networking, and sharing, product development with embedded software has become an unavoidable issue for the automotive industry. Each OEM will have its own vehicle development model, and set corresponding milestone nodes and related acceptance indicators; the same reason parts manufacturers will also have their own product development model and process. However, many product R&D processes are limited to the development process of mass-produced products, the product development with pre-research is not considered, or the pre-research product

Y. Ma (✉) · D. He · X. Tan · J. He
Chongqing Changan Automobile Co., Ltd., Chongqing, China
e-mail: myl132799@126.com

© The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd. 2022
China Society of Automotive Engineers (eds.), *Proceedings of China SAE Congress 2020: Selected Papers*, Lecture Notes in Electrical Engineering 769,
https://doi.org/10.1007/978-981-16-2090-4_101

1535

development cannot be well combined with the mass-production product development model, which resulted in missing the best opportunity for mass production. Under this background, the product R&D process and ideas based on the development of new functions, fully combined with the results of technical pre-research, timing of mass production, and harmonious supplier relationships, provide a new product R&D management idea for independent software development companies. This article combines the actual situation of product development with embedded software of domestic independent brand auto companies and the requirements of ASPICE standards, proposes a software product development mode suitable for new function development of independent brand companies, providing enterprises with the perfect for pre-research and mass production path.

1 Management Status of Pre-research Product Development

The pre-research technology is usually a forward-looking technology of an organization or industry to ensure the leading position in the development of new technologies and new products in the next 5 years or longer; while in the management of pre-research product development, the focus is on the realization of function points, followed by cost and quality. As for the pre-research and development of embedded software products [2], the focus is on system requirements, system design and analysis, software modeling development and simulation, system integration testing and preliminary calibration, and system testing; finally, the ECU software and demo environment are displayed for display to obtain a technical feasibility analysis report [3] (Fig. 1).

However, in order to develop new functions, the support of partners is usually required (if the organization can be self-sufficient); for example, the above “system design and analysis” requires the partner to do a preliminary component requirements analysis and make a cooperation intention judgment, carry out the development of the device hardware and underlying software functions [4]. Finally obtained the ECU function sample and software demo, the most important thing is to obtain the algorithm and software prototype in the pre-research product stage (Fig. 2).

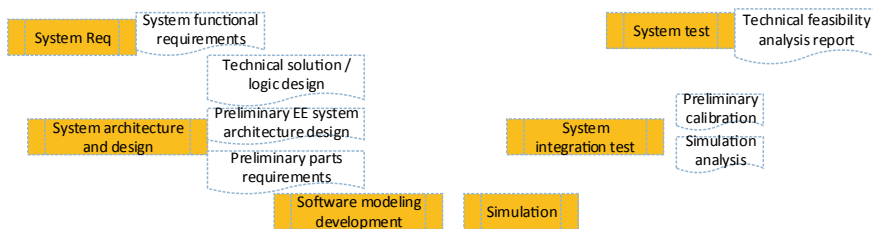


Fig. 1 Pre-research product development status

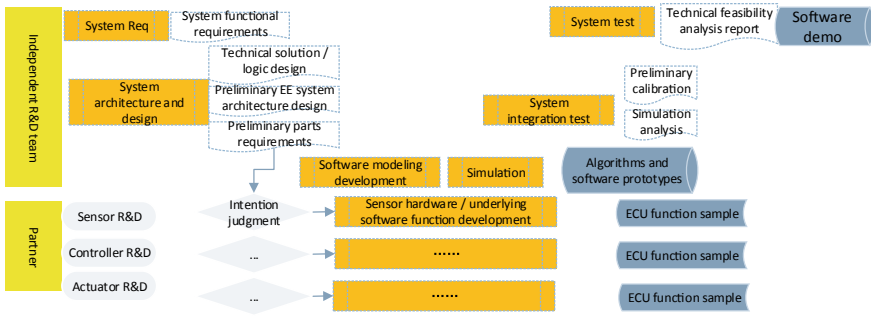


Fig. 2 Pre-research product development status

2 Management Status of Mass Production Software Products

Most companies have their own core production product development process and model, and it is a standardized product development process. For embedded software product development, the standard software development process can be used, namely the v-model development mode. Starting from receiving the product demand specification after the fixed point, the software function development is completed from the system requirements, system design, software requirements, and software design, and the milestone nodes and quality valves are set in accordance with the quality requirements; partners also follow up the development of the underlying software and hardware. The following figure is a mature product development standard process [5], and set TR1 to TR5 mass production product quality valve (Fig. 3).

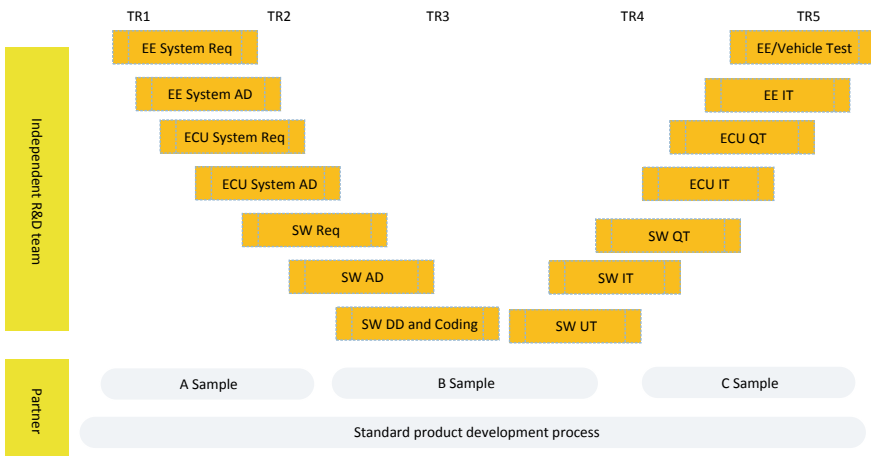


Fig. 3 Development status of mass production products

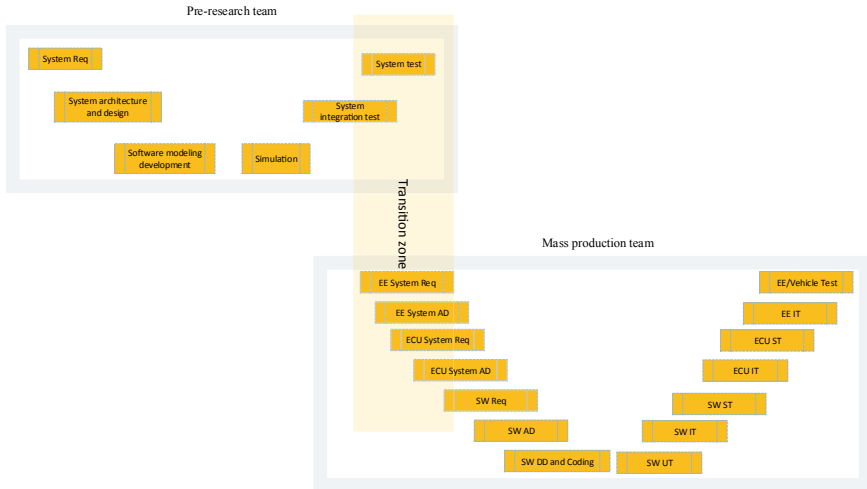


Fig. 4 New software product development model

3 New Software Product Development Model

Combining the research and development model of pre-research and mass production software products, the pre-research stage focuses on the realization of function points, while mass production emphasizes the improvement between performance and stability.

In the above new software product development model, there are two points that need to be clarified: 1. After the pre-research technology is basically stable, the pre-research team needs to reserve a small number of personnel to work with the mass production team to ensure that mass production development continues; and the mass production team in addition to the core members including the realization of technical functions, it is also necessary to focus on cost, quality, etc. to ensure the true mass production of software products; 2. Whether it is in the pre-research stage or mass production stage, it is inseparable from the strong support of partners, in order to ensure the success of mass production that it is necessary to maintain the consistency of partners, that is, stable cooperative relations and cooperative personnel.

For organizations, the following new software product development models need to be integrated into the company's mass production product development process. The following tasks need to be completed. 1. Clarify the process development stage of software products, including milestones, intermediate deliverables, and acceptance criteria; 2. Given that software is a continuous iterative development, it is necessary to clarify the incremental development stage and mode of software in the mass production product development process, such as Sample A version, Sample B version, Sample C version, etc. 3. In addition to the limitation of the research and development cycle of mass production products, the cooperation of pre-research

and mass production should also be considered, and an appropriate time should be selected for the mass production team to intervene in the pre-research team, and the pre-research team also needs to be in an appropriate time to withdraw and invest in new pre-research technology; 4. Of course, if there are large-scale technical changes in the mass production product development stage, it will be difficult to ensure that the software products developed with new functions reach the mass production level.

4 Pilot Project Software Product Development Model

Based on the core component software product development, a certain vehicle company has established a brand new technology R&D model. The detailed flow chart of the newly established product R&D model is as follows. The mass production team fully intervened, and the pre-research team gradually withdrew to invest in new pre-research technology. Based on the stable partnership, the R&D model has now been on the right track (Fig. 5).

The phased results achieved are as follows: the main functions of the software have been fully implemented in 6 months, and 80% of the mass production quality indicators have been completed, and the software has gone from the A sample version to the B sample version at the initial stage of the mass production team’s intervention [6]. This R&D model has successfully provided a model and model reference for the development of software products with complex new function development. It is no longer necessary to wait for the pre-research technology to fully mature and then organize a mass production team, which fully saves the R&D cycle and labor cost [7] (Table 1).

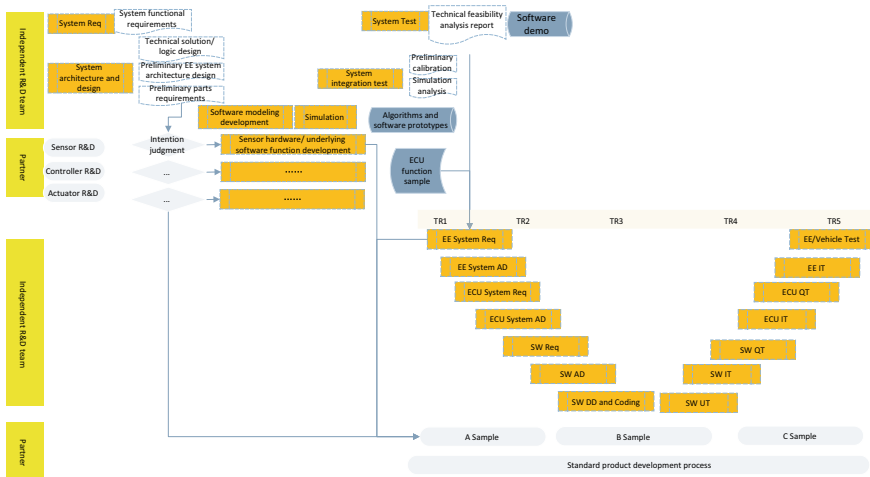


Fig. 5 Pilot project operation model

Table 1 Phased results

Item	Traditional model (pre-research and mass production)	New software product development model
Invest time	5 years (3 years pre-research + 2 years mass production)	3 years (1 year pre-research + 1 year integration + 1 year mass production)
Parts cost	2 bids (find a partner)	1 bid, and has a solid cooperative relationship
Project progress	Milestone accountability	Iterative development model (incorporating milestone requirements)

It can be seen from the staged results achieved that the new model has significantly reduced the project time compared with the traditional software development model, and because there are stable suppliers, the pilot project has reduced the bidding time by one and the cooperation between the two parties has been closer. So the new model is clearly superior in time and cost.

5 Conclusion

This article takes the development cycle of a self-branded software product (core components) with new functional development as a benchmark, and shows good performance through the pilot project's process system and staged results, and improves the company's time and cost, and details the project development schedule has been streamlined to fully ensure the achievement of the project goals [8]. It provides a new reference path for the development of software products with new technology development, as well as a specific implementation path for the organization's pre-research and mass-production product development models.

References

1. Hongyan Hu, Yongmei L et al (2006) Research on software product R&D management based on project management. *Enterp Technol Dev* 11:99–102
2. Chen Xu, Long W (2019) Analysis of business model of mainstream software R&D cloud products in the era of cloud computing. *China Telecom Ind* 06:27–29
3. Yufang Li (2014) Project-led software product R&D management model exploration. *Inf Technol Stand* 11:68–71
4. Zhao L (2014) Software product R&D management model based on project management. *Electron Technol Softw Eng* 6:91–91
5. Liu Y, Wei K et al (2020) Progress and challenges of big data software product research and development. *Sci Technol Herald* 3:84–93
6. Ma Y et al (2017) Analysis and improvement of the system card death due to U disk plug in and out of a vehicle mounted host computer. In: *Proceedings of the 2017 annual conference of the China Society of Automotive Engineering*

7. Liu S et al (2018) Research on the improvement of the organization management of software R&D project management based on Scrum method of D Company. Shandong University, pp 1–88
8. Fang Yu (2019) Quality management of automotive embedded software process. Autom Acces 11:72–73

Yun-lin Ma (1988–), a native of Dazhou City, Sichuan Province. Research interests: automotive electronics, electromagnetism and its engineering applications, automotive software engineering, automotive software capabilities and process improvement.