A PLM Accelerator for Socio-Interactive Automotive Product Development

By applying engineering analytics across the business, manufacturers can reimagine how they design, produce and deliver new products and services that resonate with customer needs and preferences.

Executive Summary

Product lifecycle management (PLM) systems have come a long way over a short time, as vendors have progressively added features relevant to the automotive industry’s requirements. However, automotive companies that have attempted to apply data distilled from social media into their PLM systems have encountered major turbulence, mostly around creating a value proposition. In fact, some PLM experts have questioned the very need for “another communication channel” in the context of PLM.

This white paper seeks to demonstrate how automotive companies can acquire and apply social media feedback in a structured and meaningful way in their PLM systems during car platform development. To overcome data collection and aggregation challenges, we propose a concept called a social PLM accelerator, or product user likes and systems engineering (PULSE). PULSE can help automotive companies collate information from diverse sources and convert it into formats that can be understood by conventional PLM systems to inform product requirements.

The Need for Social PLM in Automotive

It takes an automotive company like Toyota about 18 months to develop a product. It therefore comes as no surprise that obtaining quick access to customer expectations and preferences puts automakers at a definite advantage in this fiercely competitive market. A car owner’s feedback about his car can range from specific suggestions about a feature to a complaint about a malfunctioning component. Some of these suggestions and complaints can be translated into product requirements that can be addressed by the design team.

What better place to learn about product sentiment than on social media platforms and forums where many consumers freely share their likes and dislikes? Such insights can then be converted into user preferences that aid the design team to choose one feature over the other while launching a new car or a face-lifted version.

PLM systems are designed to address product development requirements from its inception through obsolescence. However, in our interactions with automotive companies we frequently...
observe that their design and styling departments primarily use PLM systems only for their design and manufacturing capabilities.

To tap PLM’s full potential, automotive companies must leverage the requirement management capabilities enabled by a solution that is “socially capable.” Figure 1 illustrates how social media has had a significant impact on consumer buying decisions and reveals how customer trends are evolving. Across numerous consumer-facing sectors, many companies are already striving to understand the aspirational and unstated needs of the customer using modern social feedback mechanisms.

We see automakers already using social media to gauge consumer sentiment. For example, in 2013 Ford Motor’s campaign called the Fiesta Movement sparked chatter on social media, and the user-generated feedback content became the basis for the company’s TV spots and print ads. The campaign worked so well that Ford revamped the car’s design when it introduced the 2014 Fiesta. Organizations need to more effectively feed social sentiment insights into their existing PLM systems to create a streamlined product requirements, ideation and design process. We contend the PLM system should be retrofitted to accommodate socio-interactive product development.

Defining and Highlighting the Goals of a ‘Socially Capable’ PLM System

Social PLM is a socio-interactive product development approach where customer aspirations and market trends are analyzed and converted into inter-aspirational goals (i.e., what business aspires to be and what end-users’ aspirations are) with the help of a controlled social interaction platform. A “socially capable” PLM system should have the following goals:

- The ability to collate and consolidate user feedback and information from diverse sources.
- The ability to analyze, structure and substantiate unstructured information.
- The ability to mine and summarize information from a large data pool that has been acquired by ethical Web crawling.
- The ability to logically map the requirements against the bill of materials/items/subsystems.
- The ability to quickly build templates/questionnaires that can be either broadcast or published to a large user base.
- The ability to capture demographics and psychographics.
- The ability to obtain diagnostic and usage information from the product itself using Internet of Things (IoT) platforms (e.g., sensors and other ambient forms of data collection).
Figure 2 illustrates the concept of a socially-capable PLM system. Corporations no longer want to isolate product information from related operational data. They want information to be easily exchanged and rationalized with the voice of the customer to obtain more refined consumer-driven requirements. Getting there won’t be easy, as demonstrated in the next section.

The Challenges of Implementing a Socially-Capable PLM System

Broadly speaking, automotive companies face two major challenges incorporating user feedback into mainstream PLM systems:

- Problems collating authentic feedback from users and structuring that into requirements.
- Security and content-related challenges.

Authenticity and Information Structure Obstacles

Many automotive companies use online questionnaires to obtain user feedback. To do this, their design departments post a link to a questionnaire on an e-community site with questions related to styling preferences, functionality preferences or future plans of the car user.

The key challenge is to ascertain the authenticity of the user responses. The user may answer the questionnaire casually and incorrectly. In such cases companies do not receive valuable insight from the responses. In addition, despite incentives provided by the manufacturer, it is difficult to engage and motivate car owners to provide feedback.

A second option is for the car maker to create a Web site where owners can provide feedback, detail ergonomic issues and premature wear and tear of parts, or offer positive design solutions and alerts on malfunctioning components.

Most of the opinions provided by the car users contain textual content and are unstructured. This information needs further analysis to process it and extract meaningful information regarding the issue at hand or design suggestions.

A third option is to source feedback from various car review forums. This is by far the most authentic source of information, as car users voluntarily come forward and express their opinions.

On the other hand, it is the most difficult form of information to process since the data is unstructured and far-flung (spread across numerous forums and formats).
Security and Content-Creation Challenges

Questionnaires published by the design team may contain proprietary information. The images and content of the questionnaire has to be carefully selected as it is now crossing the secure boundaries of the enterprise. Hence, it is imperative that all content that is published by the design team be subject to thorough scrutiny and approval by design, legal and corporate communications departments.

For example, if the design team intends to seek customer opinion about a steering wheel for a new car platform, publishing the design-in-progress images could result in competitors imitating the design. Therefore, some content in the questionnaire should be “masked” with approvals in place to ensure that confidentiality of content is not compromised.

Since all the design data resides in the PLM system, one way to streamline the approval process is to leverage the PLM workflow management functionality by using a PLM accelerator.

A Social PLM Accelerator Takes Root

Our PULSE social PLM accelerator enables auto-makers to connect consumer insights found on social media platforms into PLM requirements by:

- Assisting in the creation of visual and textual content for questionnaire and feedback sites.
- Providing a publishing and dynamic rendering mechanism for questionnaires and suggestion sites.
- Collating information from social intelligence platforms such as our Social PRISM and converting it into product requirements.
- Converting unstructured information from questionnaires and online feedback sites into meaningful requirements.
- Maintaining requirement traceability in the PLM system.

Figure 3 illustrates the complete process of capturing information from various social media sources and converting it into the requirements in the PLM system.

Anatomy of a Social PLM Accelerator

Figure 3
Creating Requirements from Questionnaires

In this scenario, the design engineer, along with the content creation team, creates a questionnaire in the PLM system to understand the aspirations and preferences of car users. A sample questionnaire snapshot is provided in Figure 4.

The questionnaire is subjected to an approval process in the PLM system by design, legal and corporate communications departments. Once the content is approved, an e-mail is sent to the user community registered with the automotive manufacturer. The PULSE social PLM accelerator triggers e-mails automatically using PLM workflow handlers, once all the approvals are in place.

After users respond, the output is compiled as either preferences or requirements using a sentiment-analysis tool. The information exchange between the PULSE system and the sentiment-analysis tool is carried out using either a SOAP/REST call or pure HTTP(S) requests. The collated information along with the traceability information is then updated in the PLM system, by PULSE using SOA APIs.

Thus, the entire process right from information dissemination to information update in the PLM system is automatically addressed by the PULSE accelerator.

Using a Central Feedback Site to Formulate Requirements

Here, the content design team creates a classification of a car’s interior and exterior in a tree form, and uploads it in PULSE along with relevant images.

PULSE dynamically renders the regions and the user navigation and displays it to the user.

For instance, considering the driver’s seat as a reference, the front-interior of a car consists of several portions such as a dashboard, steering, tachometer and glove box. Using PULSE screens, users can navigate from the main menu to the interior region and then to the front portion screen. This screen consists of images and text boxes, as shown in Figure 5. Textual feedback can be entered in the adjoining boxes.

Sample PULSE Screen
As in the first case, the textual feedback is subjected to NLP/sentiment analysis and post-processing, and is converted to requirements that can be understood by the PLM system.

**Requirement Formulation from Online Forums**

We have developed a social intelligence platform specifically tailor-made for automotive companies based on our Social PRISM tool. This tool gathers information and user feedback from social forums where automobiles are discussed.

PULSE sources the consolidated feedback from the Social PRISM system, analyzes it and converts it into tangible requirements.

Figure 6 illustrates the high-level architecture of the PULSE PLM accelerator, and its interaction with external systems.

Customers use a browser to fill in questionnaires or enter feedback pertaining to their cars. This information is transferred to the PULSE server using an HTTP call. All of the textual content is sent to a third-party sentiment analysis tool via a REST or an HTTP call, and the results are stored in the PULSE database for further processing. PULSE makes periodic calls to Social PRISM to fetch the summary of positive and negative sentiments from car users, and stores it in the database in a structured way. Wherever possible, it distils and captures likes and dislikes through sentiment analysis.

Finally, PULSE periodically communicates with the Teamcenter server to check any approvals for questionnaires that are due for publishing to the user community. Also, it initiates Web service calls to the Teamcenter system.

**Figure 6**

PULSE Architecture and Interactivity

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Guidelines to Improve Feedback Assimilation

To enhance the quality as well as the data content while soliciting and processing feedback from the users, we suggest the following guidelines:

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<th>Guidelines</th>
<th>Benefits</th>
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<tr>
<td>The questionnaires should contain an optimum balance of figures and textual content.</td>
<td>Improves the attention span of respondents and keeps them engaged.</td>
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<td>Questionnaires should be accessible on mobile devices and should render quickly.</td>
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<td>Questions with different connotations should be spread randomly, which forces the respondents to think before they can click on an option.</td>
<td>Improves the quality of responses.</td>
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<td>Analytics should be employed before summarizing the respondent preferences. In particular, answers with “active text content” should be given more weight as it indicates that the car owner has put in some thought before responding.</td>
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<td>Apart from extracting the connotations, keywords should be supplied to the sentiment analysis tool that can serve as a basis of extracting requirements associated with a certain feature component or functionality.</td>
<td>Helps in mining a feature’s specific user feedback.</td>
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<tr>
<td>Employ statistical models to analyze the responses.</td>
<td>Helps in extracting tangible requirements.</td>
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Benefits of a Social PLM Accelerator

We have developed a proof of concept of this accelerator using Teamcenter, a PLM system that is extensively used in the automotive and aerospace industries. Moreover, the system’s engineering module was employed for requirement traceability in Teamcenter. In our preliminary analysis, we believe a social PLM accelerator has the following advantages:

- The accelerator retrofits the PLM and serves as a social media enabler that drives business value without having to replace the system’s core. This, in turn, translates into several other benefits:
  - There is minimal training required for the design team to use the elevated functionalities.
  - Since the functionality is an extension of the existing PLM system, user-adoption issues are almost nonexistent.
  - Requirements are managed in the PLM system, encouraging the idea of a single source of truth and minimizing redundant information.
  - User preferences, trends and suggestions are available readily to the design team in the PLM system itself.
  - A part or assembly wise requirement traceability is maintained in the PLM system. This helps the design team prioritize requirements that have been sourced from the feedback.

Looking Ahead: The Future of ‘Going Social’

Most identification and classification of user feedback is currently performed by sentiment analysis and natural language processing (NLP) systems. However, NLP is still in its infancy. That makes the conversion of unstructured information somewhat error-prone. As NLP systems get more powerful and efficient, they will achieve a nearly perfect ability to process and interpret the sentiments contained in unstructured information.

Converting voice-based feedback from a complaint call into meaningful information is still a challenge, requiring manual intervention. However, with the advent of voice recognition and synthesis systems, this will likely change. Future systems will be able to convert voice feedback into words that can be efficiently processed.

A strong “connected-car” theme is emerging on the automotive front, where smart sensors and data logging systems provide plenty of diagnostic information, and the car ECUs are interconnected with each other. (See our white paper “Exploring the Connected Car.”) In the foreseeable future, this IoT trend will increase. On-board information sourcing systems will gather not only the user feedback directly but also how frequently a feature is used by the owners, to “right-size” future car variants. (See our white papers “Informed Manufacturing: The Next Industrial Revolution” and “Informed Manufacturing: Reaching for New Horizons.”)
In short, with technology advancement, the PLM system—and, consequently, the design-ideation team—will be privy to a wide range of information. Car manufacturers that embrace the potential to imbue PLM with consumer insights will certainly be in the driver’s seat.

References

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