PLM Interest Group

APPLYING AI in PLM

INDUSTRY WHITE PAPER

An industry-wide overview and Position Statement
on the potential for AI benefits in PLM.

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Foreword

The rise of Large Language Model (LLM)-based Artificial Intelligence has several parallels with the earlier surge towards the Internet of Things (IoT), in that the technology arises first, and the solutions are identified afterwards; the applications can apply to almost all aspects of a business, but offer significant and particular benefits to PLM; and there is a period of widespread confusion about how PLM could and should adopt them.

Three differences in the case of AI could make it more of a threat than an opportunity. The first is that there is a much wider spectrum of misunderstanding amongst potential adoptors, creating more opportunities for expensive mistakes. The second is that PLM is completely reliant on disciplined data management and configuration control, whereas AI may train itself differently every time. The third is that AI agents may interact with each other in a way that creates a secondary Source of the Truth.

There is no doubt that PLM needs to adopt AI and to harvest its many potential benefits. There is also no doubt that businesses that do this need to do so effectively, without wasting time or effort following false trails.

The purpose of this White Paper is to create a concise reference framework for companies from all parts of the industry so that they can cut out the hype and move straight to a sound implementation basis. The Position Statement defines where to start from, and the Vision describes the future target.

This White Paper is presented as a discussion document, and feedback is invited and welcome.

1 PLM-AI POSITION STATEMENT

No matter how far AI develops into the foreseeable future, PLM will remain of fundamental importance to product-oriented businesses.

Businesses rely on accurate PLM, and the consequences of PLM failures are well known, so the integrity of PLM must be maintained as AI is adopted.

AI has potential applications across the whole of business, of which PLM is only a part. It is likely that the requirements of other areas are much less rigorous than those of PLM.

Furthermore, AI has no structure, and cannot retain structure within its results, which may be a problem in the configuration-based world of PLM.

It is therefore important that experimentation with and adoption of AI in PLM is conducted with a thorough understanding of how PLM does and could operate; and a diligent approach that retains accuracy and control.

The PLM industry is at a stage where everybody is experimenting with AI, and learning by trial and error. This wastes effort and the errors could be expensive. If the learnings thus far were rationalised, it would produce a framework for widespread right-first-time adoption.

This White Paper proposes the first version of that framework, and feedback from all parts of the industry is invited.

AI IN PLM - THE RATIONALE

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2 PURPOSE OF THIS WHITE PAPER

The aim of this White Paper is to generate a neutral, agreed picture of the best way to approach Large Language Model (LLM) AI in the context of PLM.

As well as the endless swirl of hype around AI, we are in a situation where everybody has to experiment for themselves in order to try to understand it. This involves a lot of wasted time and effort as people try out what doesn't work as well as what does.

This White Paper brings together the principles, benefits and pitfalls of AI as it currently stands to create a starting point for right-first-time adoption.

It has been created by the PLM Interest Group based on a series of *Professional PLM* panel meetings in 2025, and the PLMIG's own experience in PLM and Knowledge Management.

It is hoped that, in addition to gathering opinions from the global PLM community, this White Paper will become a focal point for enhancing the adoption of AI, led by a common sense of understanding and purpose.

3 ONWARD DEVELOPMENT

This White Paper is designed to be developed by iteration. Input to the White Paper is open to PLM practitioners from all parts of the industry, and all parts of the world.

A Feedback Form is provided at the end of the document. All views are welcome and will be used to generate the next version. General information about the Initiative can also be requested via aiworkinggroup@plmig.com.

4 THE GOLDEN RULE

The business relies on accurate PLM, and the consequences of PLM failures are well known, so the integrity of PLM must not be damaged by AI.

Of course the integrity of PLM should not be damaged by anything, but AI entails significant new risks and so the Golden Rule should always be kept in mind.

4.1 True PLM

In simple terms, 'True PLM' is the custodian of the 'As-Designed' product configuration. It is the embodiment of the product structure that encompasses all of the possible build states, as created and signed off by the designers.

(This distinguishes it from 'Pure PLM', which is the "cradle to grave" lifecycle view.)

The first part of the Golden Rule is:-

> *"The integrity of PLM in its representation and management of the current product universe must be maintained and must not be compromised."*

4.2 Historical PLM

A very important, and sometimes forgotten, requirement of PLM is that it can recreate the exact product as it existed at any previous point in time.

The most obvious use case for this when a product that has been in the field for some years is involved in a failure or accident, and the company is being sued for damages. The company must be able to prove the product's make-up and properties at the point of sale, even if it is now no longer in production.

The second part of the Golden Rule is therefore:-

> *"The capability of PLM to recall and reproduce previous configurations of hardware, software and metadata must be maintained and must not be compromised."*

5 PLM-AI VISION

The Vision is of a future scenario in which everyone in the PLM industry applies AI optimally and efficiently.

> *"The capabilities, opportunities and risks of LLM-based AI in relation to PLM, and in relation to the overall business, are fully understood by everyone involved.*
>
> *AI adoption is approached holistically across the business, and PLM-related development is integrated with and orchestrated within the company-wide AI environment.*
>
> *The aims and targets of AI adoption are clearly defined, and the implementation works towards them in a planned and achievable way. The AI solution makes optimal use of the functionality built into the PLM system by the vendor, and of best practice learnings from the industry at large.*
>
> *Staff are trained and up-skilled for the new systems, and have the ability to monitor and control them, in terms both of system administration and visibility of the AI 'thought process'.*
>
> *A continual focus is maintained on the needs of the business, and the new and innovative possibilities that AI can enable."*

A Vision is a description of a future state, expressed in the present tense. It enables everyone to put themselves into the same future, and imagine what that will be like.

It is quite clear that, at present, the approach to AI is not like this. This White Paper proposes that it should be.

6 ACCENTUATE THE POSITIVE

6.1 Clear Aims

Everything that PLM practitioners know about launching and managing improvement initiatives, still applies. The aims and deliverables should be clearly defined, with a practical plan to achieve them.

Particular problems with AI are that there is a compulsion to 'start now' for fear of somehow being left behind; and the profusion of half-finished ideas and speculation on the Internet make it very difficult to distinguish sense from hypothesis.

"Well begun is half done" - and even companies that started on this road two or three years ago have not finished yet, so there is no rush. The aims of AI adoption can be agreed, published, and followed by efficient implementation.

6.2 Technical Possibilities

Before the aims of AI adoption can be set, adopters must have a clear understanding of what AI engines and agents can do. This is a mini-project in its own right. Not all of the functionality will apply within PLM, and it may require some thought to see what the useful parts can do in any particular environment.

6.3 Enterprise Possibilities

If the PLM Team is experimenting with AI, then other colleagues and functions are likely to be doing the same. This creates the need for coordination and orchestration, and the chance to combine technical knowledge, but it could also be an opportunity to look afresh at how the different parts of the business interact. Perhaps some long-standing PLM aims could be re-introduced for discussion.

6.4 Legacy Rationalisation

Fragmentation of legacy data is an issue for AI, as the engines work better on contiguous information. Some providers are focusing on this as a step within the AI adoption process. PLM is also likely to have long-standing legacy data issues, so the new impetus to rationalise may be helpful.

It is also possible that AI tools themselves might be useful in rationalising legacy systems, but data loss must be avoided.

6.5 New Opportunities

Once the Technical Possibilities are understood, then brainstorming-style sessions may uncover inventive new functionality that AI could provide.

The applications are likely to fall into two main categories: speeding up or automation of existing tasks; and providing insights or carrying out new tasks that were not possible before. Both categories are valuable.

An interesting question that has not yet been answered is whether LLM-based AI engines can actually emulate and manage real knowledge. This is unlikely to be a starting objective, but worth bearing in mind as adoption progresses.

6.6 Skills & Training

The task of adopting AI provides an opportunity for training and up-skilling staff, in areas ranging from requirements definition through software coding, and in AI itself.

AI may replace some jobs, but it will not replace the expertise of skilled PLM practitioners, so the whole 'knowledge environment' must be oriented around assisting and augmenting the human resource.

This can involve training in AI development itself, and training of staff in other skills (such as PLM) using AI tools.

7 GUARD AGAINST THE NEGATIVE

7.1 Abdication

One of the most insidious problems with AI, because it is so difficult to detect, is the implicit claim that "AI provides the answer". Connect it to product data, ask it to create a project plan, and one appears. It must be right because AI generated it.

This abdicates control of its workings (what logic was followed?) and of the results (are they accurate?). In no other area of PLM would this suspension of disbelief be deemed reasonable.

7.2 Software Control

An AI engine is basically a massive software application, and it needs to be managed as such. How much of it is COTS (e.g. part of the purchased PLM system); how much is a proprietary black box; and how much can and should be customised?

As the software runs on the company's platforms there may be compatibility issues, upgrade path issues, and code-writing issues.

When writing software code, writing the functionality takes about half the time. It takes equally as long to write all the error traps and close the back doors. The same applies with AI code. Staff need to have the skills to deal with this.

An untested feature of AI, which is particularly relevant to PLM, is how it deals with PLM-ALM - in other words, products that have both hardware and software content. Does it recognise revisions of software, and does it try to absorb (and therefore possibly corrupt) it? And if a new version of a product is enabled by AI, will the same AI be necessary to reconstitute that version in the future (see The Golden Rule)?

7.3 Technical Difficulties

Definition, validation, testing and proving are all more problematic with AI than with conventional applications. With conventional code you can specify exactly what the software will act on, what it will do with its inputs, what logic it will follow while it is running, what error conditions it will check for, and what outputs it will produce.

With an AI engine, much of this may be a 'black box', and even the phrasing of the question (inputs) may change the answer that is produced.

This is not insurmountable but it requires extra care, augmented by practical experience of cause and effect.

7.4 IP Bleed / Model Collapse

AI engines train themselves on the data they process, and (taking the project plan example) they can only produce sound answers if they can access all of the necessary data.

If the project plan is to take account of, say, manufacturing initiatives, then the engine must have access to their plans too - which may be commercially sensitive. Add in the Intellectual Property embodied within the PLM data, and it becomes very important to know how that newly-trained data will be used in the future.

There is also a general phenomenon of AI models known as 'Model Collapse', in that they train themselves on whatever material they encounter, whether it is good or bad; and do so recursively (training on their own results, and sometimes on the results of other models that learned those results from them). The outcome is that AI models tend to degrade as they iterate over time.

7.5 Enterprise Pitfalls

PLM reaches across the whole enterprise, and therefore any PLM-oriented AI application is likely to do the same. This could have unintended consequences for other parts of the business, either because it modifies or adulterates their data, or because it impacts on their own localised AI agents.

Manufacturing companies should be looking first at how AI can improve the whole business, before looking at 'departmental' applications. Coordination is needed to see whether there is a central approach and which other applications may be under development.

7.6 Skills & Training

New technology requires new skills, and it is unlikely that a company will have in-house AI skills when it starts on the adoption journey. Allocating staff to the project and letting them learn on the job is a guaranteed way of moving slowly.

8 INDUSTRY BEST PRACTICE

AI discussions tend to drift around because they deal in generalities and platitudes such as “strategic importance”, “shifting from execution to governing behaviour”, and even “trust deficits” when people don’t believe the answers. There is also the feeling that others are somehow making great technical strides in ways that we don't understand.

The irony is that PLM Teams and PLM providers are good at complexity. Many practitioners come from one of the engineering disciplines, where understanding and accuracy are paramount. Others may come from a software background, where if we write code we know exactly what it does and why. AI can be tamed simply by following the basics that everyone already knows.

Vendors have built AI capabilities into products that users are not sure how to apply. Advanced users have been working on their AI journey for two or three years, and still have not arrived.

The PLM industry is at a stage where everybody is experimenting with AI, and learning by trial and error. This wastes effort and the errors could be expensive. If the learnings thus far were rationalised, it would produce a framework for widespread right-first-time adoption.

The missing element is an industry-wide framework of AI best practice that everyone can follow to understand and adopt AI in the most effective way.

This White Paper is just a starting point. The *PLM-AI Position Statement* provides a common-sense grounding, the *PLM-AI Vision* provides a target scenario, and the rest provides general guidance.

The White Paper will be iterated as feedback is received, but we can do better. By collaborating and sharing ideas we can distil the neutral best practices that have been learned thus far, so that product-oriented businesses can understand and optimise how they structure and implement AI.

Establishing a framework of Best Practice in this way will improve the path to AI-enabled PLM, and the process of creating it will uncover fresh ideas for improvement.

9 FEEDBACK FORM

This is the first iteration of the White Paper, and is published for discussion. Positive and negative comments are equally useful. Feedback is welcome from any PLM practitioner from any part of the industry in any part of the world.

Name	
Organisation	
Department / Role	
Town / Country	
Email	

Comments, Feedback, or General Thoughts
... write text here ...

The content of the Feedback Forms and any subsequent conversations will remain confidential. The names of participants will not be published. Returned Forms will be compiled into an 'anonymised', non-attributable format.

When you have added your comments, simply return the whole document to whitepaper@professionalplm.org.