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**Opinion about dissertation thesis of Mr. Dineshkumar Musalekar entitled:
„New approach to dynamic management of technical knowledge
to construct a smart and flexible Die Casting Mould Manufacturing
towards intelligent manufacturing”**

The review was prepared on the basis of a contract for specific work no. IIM/D-ka/650/2026 concluded on June 22, 2026.

1. Formal presentation of the dissertation

The doctoral dissertation submitted for review consists of an introduction, six chapters on 116 pages of text, a 70-item bibliography, a list of figures, tables, and four appendices. The doctoral thesis is clearly organized, and the content of the subsequent chapters is well-chosen and presented.

In order to stay on a competitive market, manufacturing enterprises must become more flexible and implement tools and methods aligned with the concepts of Industry 4.0 and 5.0. and, in addition, must keep high quality, productivity and efficiency. We can also observe the need to integrate various aspects of the company functioning with the usage of computer systems aided production processes. These systems are becoming more and more intelligent.

The reviewed doctoral dissertation proposes a new approach to dynamic technical knowledge management in the die casting mould manufacturing process within the automotive and metal industries. The dissertation thesis meets the needs of contemporary manufacturing enterprises and contributes to the development of methods and tools that increase the efficiency of the production process based on stored technical knowledge. This knowledge remains dispersed among experienced engineers or hidden in machine records, making it difficult to use. Finding solutions, which will improve their use, significantly improve efficiency of manufacturing processes.

The first chapter precisely defines the subject matter of the work. It provides a good introduction to intelligent manufacturing, dynamic manufacturing, and technical knowledge. Furthermore, it accurately defines the objectives and scope of the work, the research problem, the research questions, and the characteristics of the proposed new method.

The second chapter precisely describes dynamic technical knowledge management in an intelligent manufacturing environment. It also presents best practices for technical knowledge management in manufacturing environments, which formed the basis of the proposed new concept of technical knowledge management in manufacturing. Five main stages were proposed, which are presented in detail in the following chapters.

Chapter 3 provides a comprehensive overview of methods and tools for knowledge collection, storage, and conversion using the Internet of Things (IoT), sensors, cloud platforms, and intelligent data acquisition systems. These tools transform raw industrial data into actionable knowledge through dashboards, heat maps, digital twins, and AR/VR interfaces. Deep learning methods, neural networks, and the use of data for predictive maintenance, fault detection, and process optimization are also presented, providing the basis for implementing the proposed novel approach to creating intelligent manufacturing systems.

The main chapter of the work is the fourth and fifth chapters which present the proposed method for technical knowledge sharing to construct a smart and flexible die casting mould manufacturing process towards intelligent manufacturing and a decision support system for dynamic and flexible machining process manage. There are very well presented the research stages, which are connected with technical knowledge acquisition, representation and structuring of technical knowledge, sharing and collaboration on technical knowledge, real-time application of technical knowledge, feedback and continuous learning.

The final, sixth chapter presents contributions to the discipline of mechanical engineering and future research directions.

The proposed research model demonstrates how technical knowledge can be dynamically centralized, digitized, and optimized using AI and IoT. The flexible structure of research model supports integration with other intelligent systems (e.g., predictive maintenance, energy monitoring), thereby constructing the foundation of an intelligent, human-centric, and sustainable die casting mould manufacturing process. From that point of view the topic of the reviewed dissertation thesis is highly up-to-date and fully justified.

2. Evaluation of the research project

The main objective of the reviewed dissertation is to develop a framework for dynamic technical knowledge management in order to build an intelligent and flexible die casting mould manufacturing and die casting process.

The author of the evaluated work focused on the finding better way for the use of technical knowledge in order to increase manufacturing process efficiency.

The thesis is properly divided into four main parts:

1. Characterization of the die casting mould manufacturing process
2. Development of a technical knowledge base for the die casting mould manufacturing process.

3. Development of a technical knowledge sharing method to build an intelligent and flexible die casting mould manufacturing process and formulation of a predictive model for disturbance detection using IoT and artificial intelligence technologies
4. Development and implementation of an IT system supporting dynamic technical knowledge management in the service department of the die casting mould manufacturing process

The developed dynamic technical knowledge management approach, implemented within the IT system, enables the formulation of recommendations regarding necessary corrective actions in the analysed process or prediction of potential defects before they occur. The system records operator feedback and measured process parameters during mould manufacturing in order to continuously improve AI models.

The scientific contribution to the discipline of mechanical engineering is a new method for dynamic technical knowledge management, enabling the development of an intelligent and flexible die casting mould manufacturing process. The research problem was solved by developing a technical knowledge base involved in the die casting mould manufacturing process in order to improve process efficiency.

The effectiveness of the proposed method was verified and confirmed under real industrial conditions through a case study of the die casting mould manufacturing process and die casting process.

3. Substantive evaluation of the doctoral dissertation, comments and questions

I assess the substantive content of the work positively. The literature review, proposed solution, research, implementation, and obtained results can yield tangible benefits in production practice.

The work contains certain inconsistencies, some of which are debatable. I have the following comments:

1. I have no reservations about the developed model for dynamic technical data management. Some analyses, descriptions of the analysed variants, and selected solutions could be clarified. For example, in Section 4.5, the many possible models were evaluated and the variant with a single hidden layer and 20 neurons was selected. This variant achieved the best accuracy on the test data (98.94%). For the presented variants, performance ranged from 96,30% to 98,94%.

What is the significance of this difference in model accuracy? How significant is this difference, and would it be preferable to use the model with 5 neurons, whose accuracy is 1% lower than the best variant?

2. The model's integration within the die-casting production line, presented in the reviewed thesis, provides both predictive insights and the ability to proactively control, which is consistent with the principles of Industry 5.0. Compliance with these principles was emphasized in the conclusion of the doctoral thesis. The main idea of Industry 5.0 is to promote collaboration between humans and intelligent machines.

What will this collaboration between humans and machines look like in the analysed die casting company? Are we moving towards replacing humans with a fully automated system controlled by artificial intelligence?

3. Implementing the proposed solutions involves investment and costs, which should be analysed at the beginning of each project and after its completion.

What are the estimated costs of implementing the proposed system? What is the approximate project implementation time? What is the project's profitability and what does it depend on?

Will the proposed solution be attractive and effective for other companies?

4. Editorial Comments

The main thesis was formulated in a clear manner, its amplification and argumentation were presented in a convincing and exhaustive way.

Generally work is well edited, but in a few places I found minor shortcomings, eg.:

- on page 68 there is an incorrect reference to table 4. In the text before the table, there are two references to tables 4 and 5, and only table 4 contains the encoded data,
- on page 89, at the beginning of section 5.3, there is a reference to section 5.4 with a description of the concept of dynamic technical data management, probably there should be a reference to section 4.
- on page 100 there is a reference to the "picture X", probably there should be a reference to a figures 16 and 17,
- on page 102 there is a reference to figure 10, but it should be a reference to figure 18
- minor shortcomings related to text formatting.

The work is well-edited. Except for minor typographical, editorial and language errors, the thesis is written in a correct and clear way. It demonstrates good level of writing techniques. Minor inaccuracies or editorial errors do not impact the merits of the work.

5. Final conclusions

I consider that the original results, which were obtained in this thesis, are:

1. The analysis of literature related to the current state of knowledge in the field of dynamic technical knowledge management.
2. A proposal for a system supporting smart and flexible die casting mould manufacturing processes.
3. A case study in an existing company demonstrating the benefits of the developed approach.
4. Practical implementation and confirmation of the effectiveness of the proposed solution.
5. The proposed approach can be applied in various industrial sectors.

To sum up my the opinion about the work, I think that it proves very well author's knowledge, both when it comes to the theory and the practice of industrial reality as well. In the thesis, a defined scientific task was formulated and successfully realized. The above-mentioned critical comments do not diminish the achievement in a significant way.

Considering good level of this work and taking into account the opinions formulated above I think that it meets the formal requirements placed to the dissertation thesis in the field of technical sciences in the discipline of mechanical engineering (Act of 20 July 2018 - Law on Higher Education and Science, Act of 14 March 2003 on the academic title and degrees and degrees and title in the field of art), and I put forward a notion for the admittance of Mr. Dineshkumar Musalekar to a public defence of dissertation work.

Bielsko-Biała, 3.09.2026

Danin Pliński