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# Ethical issues in the use of Generative Artificial Intelligence in performance management: Industrial case studies

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**Abstract.** Generative Artificial Intelligence (GAI) presents significant potential for managing Industry 4.0 companies performance, driving efficiency, reactivity and innovation and enhancing thus the performance. However, despite its advantages, the use of GAI also has several limitations, notably regarding the focus on the short-term techno-centric vision of performance and the associated ethical issues. Moreover, ethical issues that may concern numerous aspects such as data privacy, human dependence, motivation or loss of autonomy can be a threat to the overall vision of performance, particularly in the long term, as the other elements that underlie it are neglected, namely the social and the environmental ones. Aware of the importance and the benefits of using GAI, companies are looking for operational solutions that enable them to ensure long-term performance while avoiding ethical risks. Therefore, the idea put forward in this paper subscribes to the assumption that ethics in use of advanced technologies is a necessary condition for performance. Then, in keeping with performance, the use of GAI must be coupled with management of the associated ethical risks. In this sense, an exploratory analysis is proposed, from data management situations experienced by a bearing manufacturer, partner in this study. Digitalizing its manufacturing for a few years, the Company is facing cases where considering ethics becomes necessary. Hence, associated ethical risks are presented as well as their potential impact on the (efficiency-effectiveness-relevance) performance conditions, in the short, medium and long term, leading thus to the discussion of deontological rules to put in place when using GAI in performance management.

**Keywords:** Ethics - Generative Artificial Intelligence (GAI) - Performance Management - Risks - Industrial Case Studies.

## 1 Introduction

Generative Artificial Intelligence (GAI) is one of the latest technologies that is becoming widespread and quickly advancing. Academics as well as industrialists currently provide a wide overview of the use of this technology [1]. For instance, in industry, the role and the impact of the GAI in management in general is discussed [2], its large range of applications is explored [3], in engineering design [4], maintenance [5], quality control [6], supply chain management [7], etc. Integration methodologies, implementation tools as well as benefits and issues are analysed, highlighting the potential technical improvements over conventional approaches. In particular, the future format of performance management when including GAI is also investigated [8]. The use of this technology in this field is equally essentially considered as a driver for improving efficiency, productivity, delivery and response time, innovation, etc. GAI's algorithms support performance management by providing automated reporting, real-time decision support and intelligent recommendations, thus improving decision-making at all stages, from diagnosis to evaluation, reinforcing therefore the (efficiency-effectiveness-relevance) performance conditions [9]. Human decision-makers are then relieved of decisions considered routine and operational, leading them to focus, in principle, on overall strategies. Case studies and practical applications testimony to this vision [10] [11].

However, this surpassing feature of the GAI can also lead to uncontrolled systems and inappropriate decisions which therefore potentially induces ethical risks and threatens expected performance. Human dependence and replacement, loss of skills, autonomy and demotivation, misuse of data, automated judgement, are examples of ethical risks possibly encountered. The scope of such risks may be not only the industrial systems but also the associated companies or society in general, whether in short or long term. The loss of data and, consequently, of the company's expertise and intellectual property, the demotivation of humans and, consequently, the decline in their creativity, are all examples of barriers to performance.

Although awareness of the associated ethical risks is growing, the use of GAI is expanding, offering both a great answer to the performance conditions and an alignment with the competition and the market. The speed and acceleration of this use induces a need for an urgent concrete answer to the associated question of ethics. Evidence of this can be seen in the legislation promoted at EU level, through laws on the use of AI in general and the associated risks [12]. Even though frameworks and standards that have been defined to circumscribe the use of 4.0 advanced technologies in general, the proposals remain conceptual, highly focused, almost descriptive and partially handling the operational use of these advanced technologies. Indeed, among the most significant frameworks and guidelines, one can recall for instance the Corporate Social Responsibility (CSR) which essentially associates financial and non-financial aspects and covers the strategic, business and legal aspects of the companies [13], the social ISO26000 standard, reverse production and circular economy for environmental purposes [14], and the European General Data Protection Regulation (GDPR) which concerns the commitment of the processing carried out on the data by the collector [15]. By focusing more specifically on Industry 4.0, few academics are introducing the moral philosophy concept of ethics and seek to operationalize it [16]. No operational responses are thus

proposed, and even fewer for GAI use, for aiding managers in ensuring performance and managing it from an ethical point of view.

In line with previous conceptual works on handling ethics in the performance management of industrial systems of the Future [17] [18] [19], this paper explores the potential impact of the use of GAI in performance by adopting an ethical point of view. The raised question is the following: *What are the ethical risks associated with the use of GIAs in industrial systems and their short, medium- and long-term impact on performance?* Answering this question is done on the basis of case studies submitted by the NTN Europe company, bearing manufacturer and currently digitalizing its manufacturing. For that purpose, Section 2 shortly brings some elements concerning GAI features, advantages and limitations with a focus on the performance management field. Section 3 presents two industrial case studies submitted by NTN Europe, regarding its data management practices, which increasingly incorporate the use of GAI. An illustration of the identification and analysis of the ethical risks is presented, according to a methodological guideline previously developed [20]. From an analysis and generalization of these ethical risks, a study of the impact on performance, according to its (efficiency-effectiveness-relevance) conditions, is discussed in Section 4, leading to a proposal for a set of ethical rules regarding the use of GAI. Finally, concluding remarks and perspectives end the study.

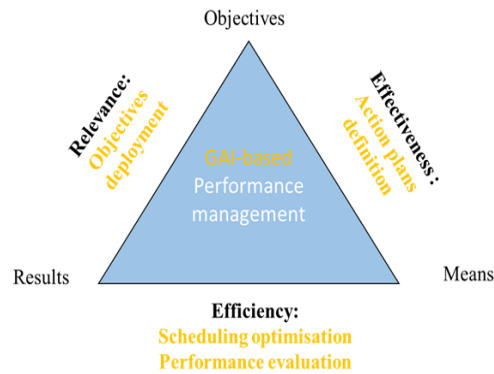
## 2 General features of GAI in light of performance management

Since the 1950s, the concept of GAI has gained in importance with the advent of neural networks and machine learning techniques. The introduction of applications such as ChatGPT [20] has set a new standard in the use of AI to generate content. From a global point of view, a GAI can be defined as: *“models that may produce new, previously unseen information dependent on the data on which they were trained. These models are developing fresh, human-like material that can be engaged with and consumed, rather than just numerical forecasts or internal rules”* [21]. GAI is essentially associated with AI and the deep learning algorithms family in particular, for learning from a broad collection of data and producing contents in coherence with it. Hence, the principle of a GAI is the production of new contents, on the basis of existing ones. These contents can be of different kinds (texts, images, videos, audios) and are instantly ready-to-use. By its potential, the use of GAI presents numerous advantages but comes also with limitations, as summarized, from our point of view, cf. Table 1.

**Table 1.** General advantages and limitations associated with the use of GAI

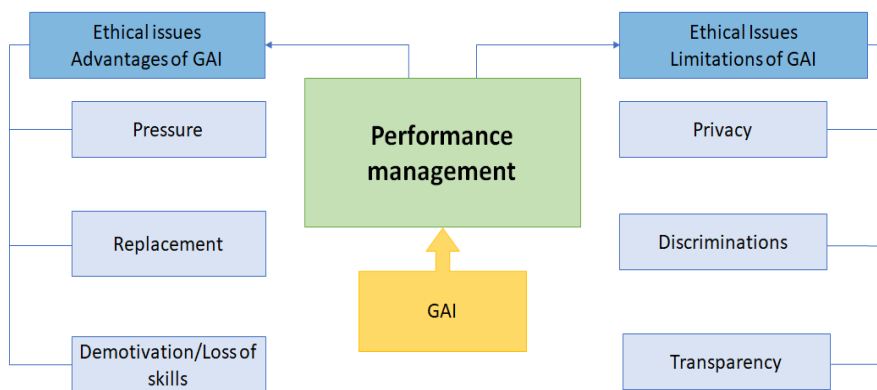
Advantages	Limitations
Generation of high-quality contents	Potential biases and mistakes in the generated contents
Analysis of a large datasets	Need for large datasets
Response in real-time	Requirement for high computational resources
Coverage of a wide range of fields	Inappropriate contents in some fields

Performance management also benefits from the advantages of GAI, as all its conditions are fulfilled as described in Figure 1.



**Fig. 1.** Performance management strengthened by the use of GAI

Additionally, some ethical issues are also highlighted with the advent of the GAI and its use in different fields [22] [23]. These risks may be due either to the limitations of the GAI or to taking exaggerated profit from its advantages. This is particularly true in industrial performance management (Fig. 2). Indeed, while performance can be optimized and its management improved, ethical issues may also appear, regarding data privacy and intellectual property of the involved business models, discriminations induced by biases in the metrics analysis, misinformation and lack of transparency with regards to the AI decisions. Moreover, humans can lose their autonomy and skills, feel demotivated or under pressure regarding a potential for advanced skills that they do not have, and even be threatened with replacement.



**Fig. 2.** Ethical issues in using GAI in performance management

Managing ethical risks is a lever for performance. But identifying specifically these risks and their impact on performance conditions remains a challenge that is addressed in the following sections.

### 3 Industrial case studies

NTN Bearings is a subsidiary of the NTN Corporation and one of the world's leading designers, developers and manufacturers of rolling bearings. With a turnover of €1.3 billion in 2023, NTN Europe is present in the automotive, rail, renewable energy and aeronautics markets. NTN Europe employs around 5,500 people, and has 15 production sites, including 7 in France. Strongly engaged in its CSR initiatives, NTN remains concerned about going further in managing the ethical risks potentially faced by its employees and society more generally. The Company is a partner in this study, submitting a number of ethical issues related to its *digital manufacturing* project, initiated a few years ago. The focus is made in this paper on the ethical risks associated with the use of GAI in the management of the data involved in the performance management of the Company. Two cases, related to the generation of code and text by using GAI and respectively local and global in scope, are submitted: 1°) GAI as a support for production and 2°) GAI designed for the entire Company.

The information related to these case studies is collected in accordance with a methodological guideline previously developed [20]. Based on a systemic vision, the guideline gathers all the elements that are necessary for the risks identification as well as its analysis, as described hereafter. For the sake of conciseness, only one risk is considered per case study.

#### 3.1 Case Study 1: GAI as a support for production

This case describes the situation where the Company uses GAI to make better exploitation of production data and optimize production support processes and associated costs (eg., use of GAI to generate lines of code within short delays, etc.). Even if it seems to have only advantages, this search for cost reduction can threaten the human being by its progressive replacement, induce processing errors and reduce the creative potential. The considered ethical risk associated is analysed in Table 2.

**Table 2.** Ethical risk associated to the use of GAI as a support for production

<p><b>Ethical risk identified</b></p> <p><b>Function/Equipment/Stakeholder</b></p>	<p><u>Title:</u> Replacement of humans by GAI in production support activities and progressively in performance management</p> <p><u>Functions:</u> Production support functions - Design, Engineering, Quality, Logistics</p> <p><u>Equipment:</u> Microsoft Copilot, Google, Raw data processing tools</p> <p><u>Stakeholders:</u> Design, Engineering, Quality, Logistics, Information Technology (IT), Compliance, CEO</p>
<p><b>Risk description</b></p>	<p>Gradually, GAI is becoming the standard for production management, leading, without the departments being aware of it, to a progressive replacement of the human, and a loss of control over the function as well as creativity.</p>

<b>Past events justifying the occurrence of the risk</b>	<ul style="list-style-type: none"> <li>- Replacement of hundreds of people by GAI throughout the world</li> <li>- Transformation of business currently underway and requirement for higher skills</li> <li>- Suppression of human assistants</li> <li>- Anticipation of the contribution of GAI to reducing production support costs</li> <li>- Self-questioning about the fact that code generated by an IT engineer using GAI can eliminate IT engineers</li> <li>- Generalization of the concept of low-cost subcontracting to a GAI</li> </ul>
<b>Exaggerated risk for all stakeholders: aberrant situations, amplification, on the assumption that the system remains in nominal operation</b>	<ul style="list-style-type: none"> <li>- Elimination of production support functions based on stabilized processes, ultimately managed by a GAI</li> <li>- Inability to control the GAI due to loss of skills</li> <li>- Loss of explainability of GAI due to its complexity</li> <li>- Put human error down to GAI</li> </ul>
<b>Imagination of possible misuse of the nominal function of the system by external threats</b>	Reinforcement learning by deliberate false or biased elements, generated by competition
<b>Imagination of possible misuse of the nominal function of the system by internal threats</b>	<ul style="list-style-type: none"> <li>- Pushing GAI into error</li> <li>- Pointing out the errors of the GAI in order to reject it and put the blame on to those responsible</li> <li>- Disempowerment and bad faith (it's not me, it's the GAI!)</li> <li>- Denouncing colleagues who have had a bad result after using GAI</li> </ul>

### 3.2 Case Study 2: GIA designed for the entire Company

This case describes the situation in which the Company uses GAI to learn from its internal data, in order to ultimately develop its own GAI, to be used by everyone in the entire company (eg., GAI is used to analyse the entire set of past emails to identify specific discussions about an event, a product, etc.). The considered ethical risk associated is analysed in Table 3.

**Table 3.** Ethical risk associated to the use of GAI designed for the entire company

<b>Ethical risk identified</b>	<u>Title:</u> Conflict arising from the gradual dehumanization/artificialization of human expertise and the Company's human values
<b>Function/Equipment/Stakeholder</b>	<u>Function:</u> Automation of access to know-how and knowledge
	<u>Equipment:</u> IA, LLM (Large Language Model)
	<u>Stakeholders:</u> All the departments

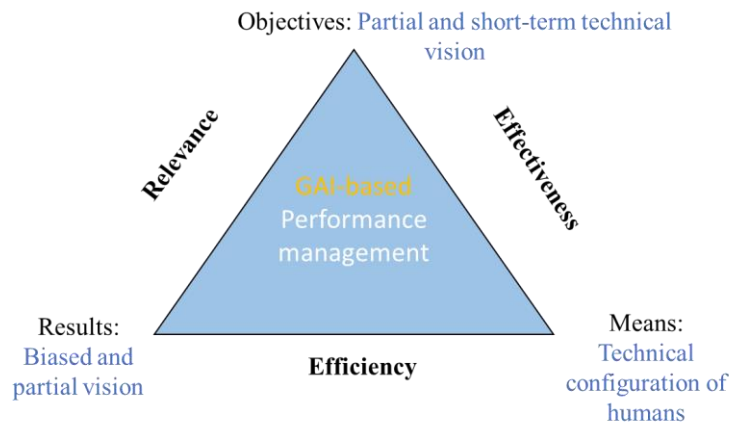
<b>Risk description</b>	<ul style="list-style-type: none"> <li>- The iterative and “painless” incorporation of modules combining AI and LLM leads to a continuous transfer of the Company's technical data and internal knowledge processing and analysis capabilities to systems that automate them.</li> <li>- Without realizing it, the Company is gradually moving away from its human values, and only realizes it is doing so later.</li> </ul>
<b>Past events justifying the occurrence of the risk</b>	<ul style="list-style-type: none"> <li>- Development and use by the Company of more and more LLM+IA tools, most recently one that allows specific and relevant information to be specified in natural language from a set of heterogeneous, numerous and previously unknown digitized data and knowledge on documents (email boxes, databases, etc.), with a long lifespan (50 years) from the Company's know-how</li> <li>- Deployment of a Chatbot (LLM+IA) on private documents with internal training base</li> </ul>
<b>Exaggerated risk for all stakeholders: aberrant situations, amplification, on the assumption that the system remains in nominal operation</b>	<ul style="list-style-type: none"> <li>- Dismissal of experts, loss of know-how to the point of having a company with no physical employees</li> <li>- No longer knowing how to deal with the unexpected: Loss of capacity for creativity in face of new issues and new developments (customer needs, technological developments, standards, requirements, customs, etc.)</li> <li>- Turning these artificial systems into suppliers to the Company through the invoicing of analysis services</li> </ul>
<b>Imagination of possible misuse of the nominal function of the system by external threats</b>	<ul style="list-style-type: none"> <li>- Loss of reputation and damage to image</li> <li>- Buyout of the Company</li> <li>Competitors denunciation of operations non aligned with human values</li> <li>Competitors denunciation of unfair dismissals</li> </ul>
<b>Imagination of possible misuse of the nominal function of the system by internal threats</b>	<ul style="list-style-type: none"> <li>- Disempowerment and loss of interest in industrial processes</li> <li>- Forcing collaborators to believe GAI more easily than themselves (GAI is never wrong!)</li> </ul>



## 4 Discussion

The case studies submitted by the Company reflect two typical situations of the use of generative AI. The first situation concerns local, short-term use, with a targeted scope and immediate impact. The second situation is more general and relates to a temporal trajectory that aims to transform the company's operation and structure. However, while they may differ in scope and temporality, it is interesting to note that the ethical risks associated with the use of GAI concern generally: 1°) the replacement of humans, 2°) the power taken over by AI, and 3°) the damage to the company's image. In terms of performance, this clearly shows the threat to long-term performance. Based on the conditions of performance (Fig.3), the impacts of the use of GIA concern all the fundamental performance parameters, namely the objectives, the means and the results:

- the objectives become the result of the AI's thinking, and are therefore set on the basis of a partial, technical and short-term vision of how the system operates, questioning thus the condition of relevance;
- the means, bringing together humans and machines, are configured according to technical, quantifiable and objective data, neglecting the human component (motivation, emotions, skills, etc.) and consequently weakening the potential of their use;
- the results are judged on the basis of a balance between a biased view of objectives and means.



**Fig. 3.** Performance threatened by the use of GAI

This reconsideration leads to the misleading conclusion that efficiency and effectiveness as well as relevance are satisfactory with using GAI. This, in turn, will lead to questionable management decisions that do not guarantee performance. Addressing this issue implies taking account of these ethical risks in performance management. According to engineering practices, the definition of ethical values and practices can be guided either by the deontological paradigm of ethics, where “one decides with the help

of immutable ethical rules” or by the utilitarian (consequentialist) paradigm, where “one decides according to the possible ethical consequences” [24]. From the situations previously analysed, and following the steps from the method used, Table 4 summarizes examples of ethical recommendations, distinguished according to the paradigm considered. In line with the three families of risks summarized above, these recommendations reinforce the following ideas:

- **Human replacement:** GAI should remain at the service of humans, not the opposite; humans must keep up their skills;
- **AI empowerment:** GAI should be seen as an aid, not as a means of making decisions; GAI can be seen at best as a trainee or at worst as a competitor, requiring thus to be under supervision;
- **Company image:** Data used and provided by GAI should be checked;
- **Performance:** GAI must be used to enhance performance.

**Table 4.** Examples of recommendations on the use of GAI in performance management

Deontological approach (rules)	Utilitarian approach (choice)
<ul style="list-style-type: none"> <li>- <b>Human skills:</b> Industrial innovation and R&amp;D must be constantly required of collaborators.</li> <li>- <b>Data protection:</b> beyond GDPR, data made available must be protected, contextualized and criticized.</li> <li>- <b>Content verification:</b> Content generated by GAI must be checked and criticized.</li> <li>- <b>Transparency:</b> The use of GAI must be advertized.</li> <li>- <b>Survey:</b> A technological survey of professional practices on the subject of the use of GAI must be conducted.</li> <li>- <b>IA Supervision:</b> An observatory or internal governance within the company must be instituted to supervise the global AI use.</li> <li>- <b>Performance impact:</b> A monitoring for GAI systems must be put in place, as well as tracking of their performance and impact on the company's performance.</li> <li>- <b>Optimization:</b> The needs of the various sectors of the company in the field of AI must be estimated, to identify the best tools that also leave the company's human values at the centre.</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Use:</b> Enable the choice of whether or not to use GAI.</li> <li>- <b>Test before Use:</b> Enable testing of the GAI before deciding to use it.</li> <li>- <b>Questioning:</b> Enable questioning about the relevance of knowledge derived from a GAI provided by colleagues.</li> <li>- <b>Accept ou Reject:</b> Give the option of accepting or rejecting proposals for GAI.</li> <li>- <b>Warning:</b> Enable alerts to be triggered if there is a suspicion that an AI is in the process of decision-making or that it is being used as a systematic decision-making tool.</li> <li>- <b>Non-exclusivity:</b> Enable suggesting using AI tools without preventing access to conventional tools.</li> </ul>

An interesting output of our study concerns an internal observatory creation (eg., committee) on the GAI use. It is indeed needed a global vision of the impact of the use of the myriad of GAI tools available and their progressive integration within industrial processes, including lifecycle analysis of these tools based for example on SWOT analysis and study of the impact on short, medium and long term industrial performance.

As a concluding remark, and looking a step further, it is possible to imagine that GAI will soon be able to capture, archive and model an employee mental activity during his day-to-day work (reasoning, behavior, ideas, emails, documents, etc.), and this for years. This huge amount of knowledge could be capitalized to create a generative human “digital twin” [25] [26] of this employee to mimic his behavior. Considering that, since one day, this employee will be no more present in the company, this generative human “digital twin” would be used as if the employee was still there. This already happens through GAI-based applications for families who face losses of members (StoryFile, YOY, etc.). This would foster us to re-imaginare enterprise knowledge management systems and would induce new kinds of challenging ethical issues.

## 5 Conclusion and prospects

This paper considered the issue of using GAI in industrial performance management. Although GAI offers advantages in the sense of performance, it also has limitations and advocates a focus on techno-centric and short-term vision of performance. Inappropriate use of this technology can then be a threat to both human well-being and performance, specifically in long-term. The industry case studies as well as the proposals developed in this article subscribe to the idea that taking into account the ethical risks associated with the use of GAI is a way to ensure performance while protecting human well-being. At this exploratory stage, the replacement of humans, the empowerment of AI and the deterioration of the company's image appear to be three families of ethical risks that need to be managed.

Identifying ethical risks and analysing their impact on performance are the first two steps in developing deontological or utilitarian rules to manage these risks. The illustrations shown in this article now need to be generalized and formalized so that they can be integrated in an operational way into performance management. Indeed, only two case study were considered and a lot more must be set to have a more global view on the ethical stakes to come.

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