



# Green Human Capital from the Millennial Perspective: Implications for Green Innovation Behaviour.

Lenny Nawangsari<sup>1, a)</sup>, Dudi Permana<sup>1, b)</sup>, and Noor Hazlina Ahmad<sup>2, c)</sup>

<sup>1</sup>*Faculty of Economic and Business, Mercu Buana University, Jakarta, Indonesia*

<sup>2</sup>*School of Management, Universiti Sains Malaysia, Penang Malaysia*

<sup>a)</sup> Corresponding author: lenny.christina@mercubuana.ac.id

<sup>b)</sup> dudipermana@gmail.com

<sup>c)</sup> noorhazlinaahmad@gmail.com

**Abstract.** The growing emphasis on sustainability has encouraged organizations to promote Green Innovation Behavior (GIB) among employees. This study investigates the effect of Green Human Capital (GHC) on GIB, with Green Commitment (GC) and Green Technological Savviness (GTS) as mediating variables, and Perceived Green Organizational Support (PGOS) as a moderating variable. A quantitative approach was employed, using survey data collected from 250 millennial employees across various industries in Indonesia. A structured questionnaire based on validated indicators was used to measure the constructs. Data were analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) to examine both direct and indirect effects. The findings reveal that GHC does not have a direct effect on GIB but significantly influences GC and GTS. Furthermore, both GC and GTS have significant effects on GIB and mediate the relationship between GHC and GIB, indicating that green human capital contributes to innovation only when facilitated by organizational commitment and technological capabilities. Meanwhile, PGOS negatively moderates the relationship between GHC and GIB, suggesting that excessive organizational support may undermine employees' innovative initiative. This study provides a new perspective by integrating GHC, GC, GTS, and PGOS into a single comprehensive model, specifically within the context of millennial employees in a developing country. It challenges the conventional assumption that organizational support always strengthens innovation, and highlights the importance of internal commitment and technological readiness as key enablers of green innovation.

**Keywords:** National Education Policy, Artificial Intelligence, Human-Centered Learning, Digital Transformation.

## 1 Introduction

Sustainability has emerged as a pivotal agenda in the contemporary business landscape, compelling organizations to implement environmentally responsible strategies to ensure long-term viability and competitiveness. In this context, Green Innovation Behavior (GIB) the proactive efforts of employees to develop and apply environmentally friendly solutions plays a crucial role. GIB encompasses a wide array of actions, including the creation of sustainable products, optimization of production processes for energy efficiency, and the reduction of environmental waste [1]. Central to promoting GIB is Green Human Capital (GHC), which refers to the accumulation of environmental knowledge, technical skills, and ecological values within the workforce. Recognized as a strategic intangible resource within the Resource-Based View (RBV), GHC provides the foundation for innovation that supports corporate sustainability agendas [2].

Millennial employees currently the dominant generation in the global workforce present a unique opportunity in this transformation [3]. They are not only tech-savvy and highly adaptable but also exhibit strong pro-environmental values and a preference for working in organizations that align with their sustainability ideals. However, empirical evidence suggests that GHC alone may not directly translate into green innovation behaviors, particularly among millennials who value autonomy, personal development, and meaningful contribution over formal directives. Consequently, other psychological and contextual mechanisms may be necessary to activate the potential of GHC. In terms of technology, GHC significantly contributes to GTS employees' adaptive capacity to leverage technology for sustainability goals [4]. High-quality human capital, supported by sustainability-oriented education and health, has a significant impact on green technological innovation, especially among millennials who are known for their creativity in using technology for eco-friendly solutions. GHC bridges technological competencies and sustainable innovation in the digital age [5]. Moreover, GHC has been recognized as a critical component in building green intellectual capital through training, improving business strategy and performance, and supporting green innovation in the context of the circular economy.

Recent studies and expert insights highlight the importance of additional variables in this relationship, such as Green Commitment (GC), Green Technological Savviness (GTS), and Perceived Green Organizational Support (PGOS). GC represents employees' emotional and psychological attachment to environmental goals, fostering a personal sense of responsibility and willingness to innovate in alignment with sustainability. GC is a key factor in enhancing GIB. GC influences employee green behavior, shapes organizational green practices, and supports knowledge sharing for competitive advantage. While it has a direct and significant effect on green innovation, limited research has examined the role of specific GC dimensions in driving different forms of green innovation.

GTS captures employees' ability to utilize digital tools and eco-technologies in support of green practices, thereby enabling the translation of environmental knowledge into actionable innovation. GTS itself plays a central role in promoting GIB. Leaders' technological competence, the adoption of smart green technologies, and integration of tools such as AI have all been shown to significantly support green innovation behavior. However, the specific mechanisms linking GTS to GIB particularly regarding external pressures and organizational dynamics remain underexplored.

PGOS refers to employees' perception of how much the organization supports and values green initiatives through policies, training, and recognition systems, which can shape the motivation to engage in innovative behavior. PGOS significantly contributes to GIB. PGOS enhances employee motivation and engagement in green innovation, facilitates team learning around environmental issues, and strengthens the relationship between green leadership and sustainable HRM in boosting innovation performance. However, overly formal or normative support may suppress individual initiative and autonomy, thereby weakening the impact of GHC on innovation. Nevertheless, some studies caution that excessive or rigid organizational support may lead to a crowding-out effect, diminishing intrinsic motivation and innovation initiative among employees.

While these variables have frequently been examined separately, limited research has constructed a comprehensive model that captures their interaction in influencing GIB, especially among millennial employees in emerging economies. This study seeks to bridge that gap by analyzing the mediating effects of GC and GTS alongside the moderating influence of PGOS on the linkage between GHC and GIB. In doing so, it proposes an integrated perspective for explaining how green innovation behavior may be fostered through aligned human resource strategies, technological enablement, and organizational support systems. Consequently, the study contributes both conceptual and practical value to the advancement of sustainable human resource management. The research framework formulated to illustrate these relationships is presented in Figure 1.

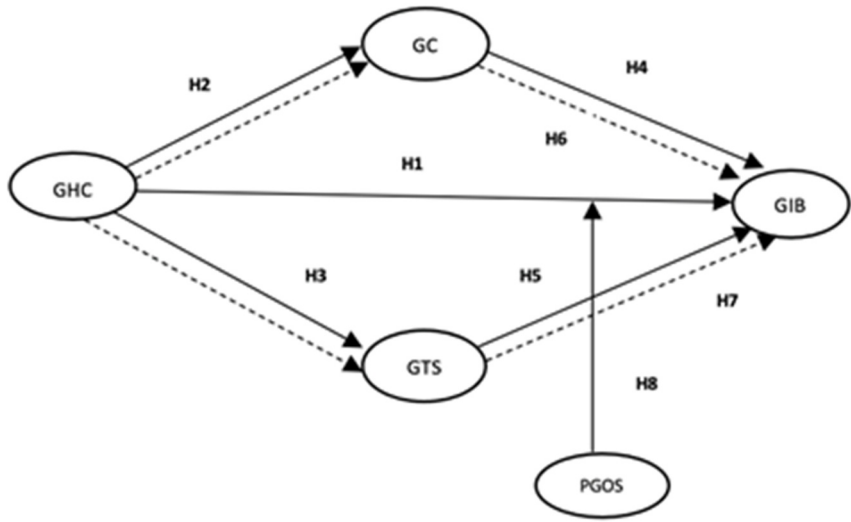


FIGURE 1. Research Framework

Hypotheses:

H1: Green Human Capital has a positive and significant effect on Green Innovation Behavior.

H2: Green Human Capital has a positive and significant effect on Green Commitment.

H3: Green Human Capital has a positive and significant effect on Green Technological Savviness.

H4: Green Commitment has a positive and significant effect on Green Innovation Behavior.

H5: Green Technological Savviness has a positive and significant effect on Green Innovation Behavior.

H6: Green Commitment mediates the relationship between Green Human Capital and Green Innovation Behavior.

H7: Green Technological Savviness mediates the relationship between Green Human Capital and Green Innovation Behavior.

H8: Perceived Green Organizational Support moderates the relationship between Green Human Capital and Green Innovation Behavior

## 2 METHOD

This research adopts a quantitative methodology to analyze the effect of Green Human Capital (GHC) on Green Innovation Behavior (GIB), incorporating Green Commitment (GC) and Green Technological Savviness (GTS) as mediating variables, while Perceived Green Organizational Support (PGOS) functions as a moderating factor [6]. Information was obtained through a structured survey administered to 250 millennial workers across multiple sectors in Indonesia using a purposive sampling technique. Each construct was operationalized using measurement indicators validated in prior studies. Statistical evaluation was performed through Partial Least Squares Structural Equation Modeling (PLS-SEM) to assess both direct and indirect relationships within the conceptual model.

### 3 Result and Discussion

The results of the analysis using SEM-PLS can be seen Figure 2.

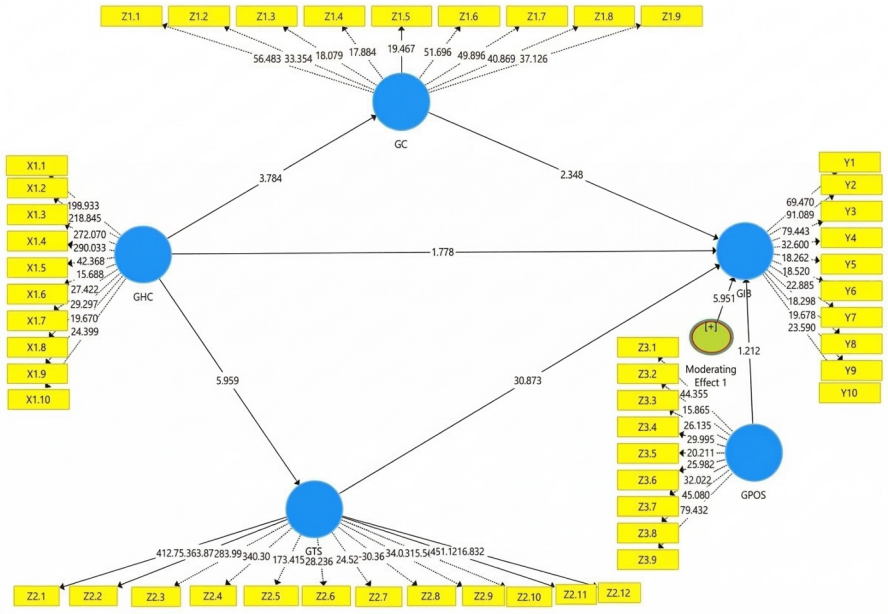


FIGURE 2. Bootstrapping PLS

#### 3.1 Test Results of Hypothesis Testing

The results of testing the research hypothesis can be seen in table 1

TABLE 1. Hypothesis Testing

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ((O/STDEV))	P Values
Direct Effects					
GC -> GIB	0,063	0,064	0,027	2,343	0,020
GHC -> GC	0,241	0,249	0,068	3,526	0,000
GHC -> GIB	0,246	0,231	0,126	1,959	0,051
GHC -> GTS	0,467	0,471	0,064	7,343	0,000

GTS -> GIB	0,817	0,815	0,026	31,877	0,000
Moderating Effect 1 - > GIB	-0,277	-0,274	0,039	7,135	0,000
Indirect Effects					
Green Human Capital -> GC -> GIB	0,015	0,016	0,008	1,974	0,049
Green Human Capital -> GTS -> GIB	0,382	0,384	0,051	7,551	0,000

Based on the statistical analysis, hypotheses H2, H3, H4, H5, H6, and H7 are supported, while Hypothesis H1: Green Human Capital has a positive and significant effect on Green Innovation Behavior is not supported. Additionally, Hypothesis H8: Perceived Green Organizational Support has a negative moderating influence on the relationship between Green Human Capital and Green Innovation Behavior is supported [7]

The study findings indicate that Green Human Capital (GHC) does not have a significant effect on Green Innovation Behavior (GIB). This result is particularly relevant for millennial employees, who tend to be autonomous, critical, and selective toward organizational culture [8]. They do not automatically channel their environmental knowledge into innovation without tangible organizational support and a work environment that fosters creativity. Millennials' strong focus on self-development may lead to low motivation for innovation if there is no clear reward system or if innovation is not aligned with their personal goals [9]. Thus, the effect of GHC on GIB may require mediation through constructs such as green psychological ownership. Millennials are more likely to engage in innovative behavior when there are incentives, recognition, and direct feedback [10]. Moreover, a misalignment between personal values and a symbolic or superficial green culture can further reduce their innovative participation, even when GHC is high [11]. This finding contradicts the findings of previous researchers, who found that GHCs encourage green innovation through creativity and environmental technical competence, and also research which showed that GHCs enhance competitiveness by increasing environmentally friendly product and process innovation [12].

The findings reveal that Green Human Capital (GHC) has a positive and significant effect on Green Commitment. Millennials, having grown up with sustainability values, are more likely to commit to an organization's environmental goals when they possess green knowledge and attitudes [13]. They tend to choose organizations that align with their personal values, and GHC strengthens their attachment to environmentally responsible workplaces. Moreover, GHC enhances green self-efficacy the confidence to make meaningful environmental contributions which, in turn, fosters emotional commitment to sustainability [14]. For millennial employees, GHC supports their values, identity, and desire to engage in meaningful work within organizations that prioritize environmental care. These findings are supported by prior research, who found that green competencies and training promote employees' commitment to the environmental values and mission of their organizations [15].

Green Human Capital (GHC) has been found to significantly influence Green Technological Savviness (GTS) among millennial employees. Millennials, having grown up in the digital era, are highly familiar with technology in their daily lives. When equipped with GHC comprising environmental knowledge, skills, and awareness they are more likely to quickly absorb and utilize green technologies [16]. This makes millennial employees more adept at understanding, selecting, and applying environmentally friendly technologies. GHC plays a critical role in enhancing individuals' ability to comprehend, adopt, and effectively implement green technology in the workplace. This finding is supported by prior research which shows that GHC enhances green technology proficiency due to millennials' openness to learning and innovation [17].

Millennial employees with strong Green Commitment (GC) feel emotionally and morally attached to their organization's environmental goals [18]. This commitment motivates them to propose eco-friendly ideas, seek more efficient and sustainable work practices, and act proactively to support green transformation. Millennials tend to work harder and more creatively when they perceive their work as meaningful and aligned with their personal values. For them, green innovation is not merely a task but a form of value expression [19]. As a result, millennial employees with high GC are more active and creative in generating green solutions within their organizations. This finding is supported by previous research, who found that Green Commitment enhances employees' intrinsic motivation to act innovatively in environmentally responsible ways [20]. GC shapes both intention and behavior toward green innovation. Previous studies emphasize that value-based commitments encourage voluntary pro-environmental behavior, fostering green innovation. Other previous research further confirmed that GC has a direct and significant effect on Green Innovation Behavior (GIB) by increasing intrinsic motivation and engagement [21].

Green Technological Savviness (GTS) reflects an individual's ability and readiness to understand, access, and utilize environmentally friendly technologies [22]. Employees with high GTS are better equipped to identify opportunities for energy efficiency, emission reduction, and the digitalization of green processes. They are also more capable of creating or modifying products, processes, or services to be more sustainable [23]. GTS enables individuals to apply green technologies in creative ways, which directly fosters Green Innovation Behavior (GIB). Several previous studies that support this study show that mastery of green technology by individuals and organizations strengthens innovation capacity and sustainable performance. Furthermore, it was found that employees with high GTS are more capable of improvising technology in producing green innovations [24].

Green Human Capital (GHC) provides employees with environmental understanding, competencies, and values that support ecological responsibility. Nevertheless, possession of knowledge alone does not automatically translate into innovative conduct, particularly in multifaceted organizational settings. Motivational and affective engagement embodied in Green Commitment (GC) plays a vital role in converting environmental insight into creative action. GC reflects a psychological bond and emotional dedication to the sustainability objectives of the organization. Employees demonstrating strong GC tend to experience ethical involvement, a sense of responsibility to contribute, and intrinsic encouragement to develop environmentally oriented solutions. In this way, GC functions as an essential linkage connecting individual capability (GHC) with observable conduct (Green Innovation Behavior/GIB). Environmental knowledge and value orientation enhance awareness and nurture personal dedication, which subsequently stimulates voluntary and inventive initiatives, such as proposing novel ideas or refining procedures to improve ecological sustainability. Green commitment therefore constitutes a primary mechanism through which green human resource practices foster environmentally responsible innovation. Correspondingly, earlier studies have indicated that GC operates as an enabling factor that transforms GHC into tangible outcomes manifested through green innovative actions.

Green Human Capital (GHC) equips individuals with environmental knowledge, skills, and awareness. Meanwhile, Green Technological Savviness (GTS) reflects an individual's ability, readiness, and confidence in accessing, understanding, and utilizing green technologies. When individuals with high GHC also possess strong GTS, they are more likely to proactively adopt green technologies, develop sustainable digital solutions, and confidently propose and implement technology-based green innovations. Employees with strong GHC tend to be more interested and motivated to learn and use green technologies. Through GTS, they can effectively translate their environmental knowledge into innovative actions by applying green technologies in practical ways. Previous studies suggest that Green Human Capital (GHC) fosters innovation by enhancing proficiency in green technologies and facilitating the transfer of environmental knowledge. However, knowledge alone does not necessarily lead to green innovation unless employees are able to effectively apply it through technology-enabled practices.

This research demonstrates that Perceived Green Organizational Support (PGOS) moderates the relationship between Green Human Capital (GHC) and Green Innovation Behavior (GIB), although the direction of moderation is negative. The result indicates that stronger organizational support may diminish the beneficial influence of GHC on GIB. Such conditions may arise when institutional support is experienced as highly procedural or prescriptive, limiting personal initiative and independence. This outcome is consistent with prior findings suggesting that PGOS moderation may become adverse when excessive assistance generates perceptions of pressure or normative oversight. Additional studies likewise indicate that support lacking alignment with employee expectations or autonomy can hinder innovative behavior rather than encourage it.

#### 4 Conclusion

Based on the research results, Green Human Capital (GHC) has no direct influence on Green Innovation Behavior (GIB), but significantly influences Green Commitment (GC) and Green Technological Savviness (GTS). Furthermore, both GC and GTS were found to have a significant influence on GIB and mediate the relationship between GHC and GIB, indicating that green human resource capacity contributes to innovation only when mediated by organizational commitment and technological capability. Meanwhile, Perceived Green Organizational Support (PGOS) negatively moderates the relationship between GHC and GIB, indicating that excessive organizational support can actually suppress employee innovative initiatives.

## Acknowledgments

The authors would like to express their sincere appreciation to the millennial employees who participated in this study and generously shared their time and insights. Gratitude is also extended to the supporting institutions, including Mercu Buana University and Universiti Sains Malaysia, for their academic encouragement and collaborative support throughout the research process. The authors are likewise thankful to colleagues and reviewers whose constructive feedback contributed to the refinement and completion of this study.

## References

1. Heslie Ree Pontillo, Shienna Mae Dominguez, Angel Rhea Bustamante, Aryanly Genodiala, Scott Gahum, Valerie Anne Rose Pontillo, Estherlina Jr. Pontioso, dan Felix Villaluz II, "The Mediating Role of Green Human Capital in the Relationship Between Green Human Resource Management Practices and Green Employee Behavior for a Sustainable Future," *Sustainability* 17, no. 23 (2025): 10767
2. Ika Pratiwi, Asep Saefudin, Gema Ika Sari, Budi Ilham Maliki, Fauzi, Soenyono, Basrowi, dan Uli Wildan Nuryano, "Green Human Capital and Organizational Performance: The Role of Employee Environmental Awareness and Sustainable Innovation in Achieving Organizational Sustainability," *Innovation and Green Development* 4, no. 3 (2025): 100244
3. Ming Yang, Hui Li, dkk., "The Influence of Green Human Resource Management on Employees' Green Innovation Behavior: The Role of Green Organizational Commitment and Knowledge Sharing," *Heliyon* 9, no. 11 (2023): e22161
4. Yunzhou Ma, dkk., "Employee Green Innovation Behavior Based on the Ability-Motivation-Opportunity Framework: Fuzzy-Set Qualitative Comparative Analysis," *Frontiers in Sustainability* 5 (2024): 1415832
5. Jing Zhu, dkk., "Influence of Environmentally Specific Transformational Leadership on Employees' Green Innovation Behavior—A Moderated Mediation Model," *Sustainability* 14, no. 3 (2022): 1828
6. Gökhan Kerse, "The Effect of Perceived Green Organizational Support on Employee Green Behavior: The Moderating Role of Long-Term Orientation," *Brazilian Journal of Operations & Production Management* 21, no. 1 (2024)
7. Mohammad Aboramadan dan Osman M. Karatepe, "Green Human Resource Management, Perceived Green Organizational Support and Their Effects on Hotel Employees' Behavioral Outcomes," *International Journal of Contemporary Hospitality Management* 33, no. 10 (2021): 3199–3222.
8. Mohammad Aboramadan, Jody Crawford, Mehmet A. Turkmenoglu, dan C. Farao, "Green Inclusive Leadership and Employee Green Behaviors in the Hotel Industry: Does Perceived Green Organizational Support Matter?," *International Journal of Hospitality Management* 107 (2022): 103330
9. Rahi, Samar. (2021). *Investigating the Role of Online Service Quality, Customer Trust and Satisfaction in Fintech Adoption Using PLS-SEM*. Journal of Retailing and Consumer Services, 61, 102584.
10. Gupta, S., Malhotra, N., Czinkota, M., & Foroudi, P. (2023). *Survey Research in the Digital Era: Applications and Advancements*. Journal of Business Research, 156, 113486.
11. Sarstedt, Marko., Ringle, Christian., & Cheah, Jun-Hwa. (2020). *Structural Model Robustness Checks in PLS-SEM*. Industrial Management & Data Systems, 120(12), 2211–2241.
12. Nguyen, T. N., & Luu, T. T. (2023). *Green Human Capital and Employee Green Innovation: The Mediating Role of Creativity*. Journal of Cleaner Production, 398, 136725.
13. Al-Ghazali, B. M., et al. (2022). *Green Human Capital and Competitive Green Innovation*. Business Strategy and the Environment, 31(3), 1084–1098.
14. Pham, N. T., Doan, D. T., & Phan, Q. P. (2020). *Green Training and Green Commitment Among Employees*. Asia Pacific Journal of Human Resources, 58(2), 132–152.
15. Chen, X., Tan, Y., & Zhou, Y. (2020). *How Green Human Capital Enhances Green Technology Proficiency*. Technovation, 96, 102155.
16. Chaudhary, R. (2022). *Green Commitment and Innovative Environmental Behavior*. Personnel Review, 51(8), 1893–1912.
17. Luu, T. T. (2021). *Value-Based Commitment and Voluntary Green Behavior in Organizations*. Journal of Organizational Change Management, 34(6), 1360–1381.
18. Ren, S., Tang, G., & Jackson, S. (2022). *Linking Green Commitment to Employee Green Innovation*. Human Resource Management Review, 32(4), 100876.

19. Kraus, S., Rehman, S., & García, F. (2020). *Corporate Green Technology Adoption and Innovation Capacity*. Journal of Environmental Management, 271, 110944.
20. Y.-S. Chen and C.-H. Chang, "Green human capital and green innovation," *J. Bus. Ethics*, vol. 162, no. 4, pp. 789–806, 2020, doi: 10.1007/s10551-018-3795-1.
21. Z. Song, "Green HRM and green innovation performance," *J. Clean. Prod.*, vol. 247, p. 119116, 2020, doi: 10.1016/j.jclepro.2019.119116.
22. J. F. Hair, G. T. M. Hult, C. M. Ringle, and M. Sarstedt, "PLS-SEM: Updated guidelines," *Eur. Bus. Rev.*, vol. 31, no. 1, pp. 2–24, 2019, doi: 10.1108/EBR-11-2018-0203.
23. L. Tang, "Millennials and sustainable innovation behavior," *J. Bus. Res.*, vol. 123, pp. 436–447, 2021, doi: 10.1016/j.jbusres.2020.10.022.
24. J. H. Yong, M. Y. Yusliza, and T. Ramayah, "Green human resource management and green innovation," *J. Clean. Prod.*, vol. 231, pp. 122–135, 2019, doi: 10.1016/j.jclepro.2019.05.009.

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

