INFORMATION AND ANALYTICAL SYSTEMS MONITORING GENDER EQUALITY IN UNIVERSITY FACULTY CANDIDATE SELECTION

Abstract. This article aims to develop and implement information and analytical systems to monitor and promote gender equality in the selection of university faculty candidates. Addressing the persistent issue of gender disparity in academia, the study presents a comprehensive approach to achieving equitable representation among faculty. The research identifies critical components for an effective monitoring system: data collection and integration, standardized metrics, bias detection algorithms, reporting tools, candidate evaluation systems, training modules, compliance mechanisms, feedback systems, predictive analytics, and stakeholder engagement platforms. These elements collectively work to enhance transparency and equity in faculty selection processes, offering a robust solution to an enduring problem.

The findings of this study provide a significant contribution to the field by offering a structured framework for institutions to follow, ensuring fair and unbiased candidate evaluations. By integrating these elements, the proposed system facilitates the creation of unbiased hiring practices, promoting a diverse and inclusive academic environment. This research presents a novel integration of information and analytical systems tailored specifically to monitor gender equality in faculty selection. Unlike previous studies, it offers a holistic approach that incorporates bias detection, standardized metrics, and stakeholder engagement.

The proposed framework addresses both technical and organizational challenges, providing a valuable tool for academia to enhance diversity and inclusion. The study's innovative approach distinguishes itself by not only highlighting the need for equitable representation but also by offering practical solutions to achieve it. The integration of predictive analytics and feedback systems ensures continuous improvement and adaptation of the monitoring process, making it a dynamic and effective solution. By implementing these systems, universities can move towards more transparent, equitable, and inclusive hiring practices, ultimately contributing to the broader goal of gender equality in academia.
Криворучко Олена Володимирівна доктор технічних наук, професор, завідувач кафедри інженерії програмного забезпечення та кібербезпеки, Державний торговельно-економічний університет, вул. Кіото, 19, м. Київ, 02156, тел.: (097) 239-15-11, https://orcid.org/0000-0002-7661-9227

ІНФОРМАЦІЙНО-АНАЛІТИЧНІ СИСТЕМИ МОНІТОРИНГУ ГЕНДЕРНОЇ РІВНОСТІ ПРИ ВІДБОРІ КАНДИДАТІВ НА ПОСАДИ ВИКЛАДАЧІВ УНІВЕРСИТЕТІВ

Анотація. Метою статті є розробка та впровадження інформаційно-аналітичних систем для моніторингу та просування гендерної рівності у процесі відбору кандидатів на посади викладачів університетів. Звертаючись до постійної проблеми гендерної нерівності в академічних колах, дослідження представляє комплексний підхід для досягнення справедливого представництва статей серед викладачів. У дослідженні визначено критичні компоненти ефективної системи моніторингу: збір та інтеграція даних, стандартизовані метрики, алгоритми виявлення упереджень, інструменти звітності, системи оцінювання кандидатів, навчальні модулі, механізми дотримання вимог, системи зворотного зв'язку, прогностична аналітика та платформи для залучення зацікавлених сторін. Ці елементи сприяють підвищенню прозорості та справедливості у процесі відбору викладачів, пропонуючи надійне вирішення проблеми забезпечення гендерної рівності.

Результати дослідження є значним внеском у теорію питання, пропонуючи структуровану систему відбору, якою може дотримуватися заклади освіти, забезпечуючи справедливе та неупереджене оцінювання кандидатів. Запропонована система сприяє створенню неупередженої практики найму на роботу, просуваючи різноманітність та інклюзивне академічне середовище. Це дослідження представляє нову інтеграцію інформаційно-аналітичних систем, розроблених спеціально для моніторингу гендерної рівності при відборі викладачів. На відміну від попередніх досліджень у статті запропоновано цілісний підхід, який охоплює виявлення гендерних упереджень, стандартизовані показники гендерної рівності та залучення зацікавлених сторін під час відбору кандидатів.

Запропонована система вирішує як технічні, так і організаційні проблеми, посилення різноманітності та інклюзії в академічних колах. Інноваційний підхід дослідження вирізняється тим, що у статті не лише підкреслено необхідність справедливого представництва, але й запропоновано практичні рішення для його досягнення. Інтеграція прогностичної аналітики

Keywords: faculty selection, gender bias, gender equality, information and analytical systems, university.
Statement of the problem. Gender equality in the selection of university faculty candidates remains a significant challenge in academia. Despite various initiatives and policies aimed at promoting diversity and inclusivity, many institutions still struggle to achieve equitable representation of genders among their faculty. This disparity not only undermines the principles of fairness and equality but also hampers the diversity of thought and experience that is crucial for academic excellence and innovation.

The selection process for university faculty positions is often susceptible to biases, both conscious and unconscious, that can skew hiring decisions in favor of certain groups. Traditional methods of candidate evaluation and selection may inadvertently perpetuate these biases, leading to systemic gender imbalances. Furthermore, the lack of standardized metrics and consistent data collection practices across institutions exacerbates the difficulty in assessing and addressing gender disparities effectively.

In recent years, the integration of information and analytical systems has emerged as a promising solution to these challenges. These systems have the potential to provide comprehensive data analysis, identify patterns of bias, and facilitate more transparent and equitable selection processes. However, the development and implementation of such systems come with their own set of challenges. Issues such as data breaches, biased algorithms, incomplete data, human error, and technical failures pose significant threats to the reliability and integrity of these systems.

To address these challenges, it is crucial to develop robust information and analytical systems that can effectively monitor and promote gender equality in faculty candidate selection. These systems must incorporate various elements such as data collection and integration, standardized gender equality metrics, bias detection algorithms, and compliance monitoring mechanisms. Additionally, they must be resilient to potential threats and adaptable to evolving technological and institutional landscapes.

The problem of achieving gender equality in university faculty candidate selection is multifaceted and complex, requiring a comprehensive and systemic approach. By understanding the key components and threats associated with
information and analytical systems, institutions can better design and implement strategies to promote fairness and diversity in their faculty selection processes.

**Analysis of recent studies and publications.** The issue of gender equality in academia has garnered considerable attention in recent years, with numerous studies examining various aspects of faculty hiring processes. The studies collectively highlight the complexities and nuances of implementing gender equality policies and underscore the importance of systemic approaches to address entrenched biases and barriers.

Henningsen, Horvath, and Jonas [1, p. 46] examine the impact of affirmative action policies on the hiring of female assistant professors, finding that such policies can positively influence the perception and hiring of female candidates for associate professor positions. Their study indicates that male evaluators show a stronger preference for female candidates under gender-based selection conditions, suggesting that affirmative action policies may align with meritocratic ideals and support gender equality initiatives. This finding challenges the notion that affirmative action undermines meritocracy and highlights the potential for these policies to positively impact hiring decisions.

Abramo, D'Angelo, and Rosati [2, p. 400-401] explore favoritism in university selection committees, particularly in the Italian academic context. Their study reveals that committees led by women prioritize scientific merit more than those led by men, suggesting that increasing female representation in leadership roles within selection committees could lead to fairer assessments. However, the persistence of favoritism, regardless of gender, indicates the need for systemic changes to address deeply ingrained biases in academic recruitment.

Manfredi, Clayton-Hathway, and Cousens [3, p. 168] highlight the role of executive search firms (ESFs) in promoting gender diversity in UK Higher Education Institutions (HEIs). Their research, framed within the Public Sector Equality Duty (PSED), led to the development of a Diversity Principles Framework (DPF) aimed at improving equality outcomes in HEI recruitment processes. The study emphasizes the importance of client commitment and compliance with equality legislation in the effectiveness of ESFs in promoting gender diversity. This finding underscores the need for institutional commitment to equality principles to drive meaningful change in recruitment practices.

Chang and Hu [4, p. 226-227] focus on the impact of higher education system expansion on faculty gender parity, using transfer function and ARIMA models to analyze trends. Their study suggests that while system expansion can reduce gender disparity, underlying causes and mechanisms driving these changes remain unclear. The authors advocate for cross-country comparisons to further investigate gender parity trends and highlight the importance of collaborative research in addressing gender equality concerns globally.
Carlsson, Finseraas, Midtbøen, and Rafnsdóttir [5, p. 406-407] investigate bias in academic recruitment through a survey experiment in Nordic countries. Their findings challenge the notion of bias against women, showing that female candidates are perceived as more competent and hireable than their male counterparts. This result suggests that institutionalized gender equality norms in the Nordic region may contribute to this bias in favor of female candidates. However, the persistent gender gap in top-level academic positions indicates the need to explore other factors, such as career sorting mechanisms, that influence gender disparities in academia.

James and Brower [6, p. 220785] use mathematical modeling to assess strategies for achieving gender parity in academia, focusing on New Zealand's research evaluation system. Their study emphasizes the importance of tailored approaches to hiring and promotion policies, suggesting that a balanced strategy adjusting both levers is prudent. The findings highlight the need for universities to implement evidence-based HR strategies that consider the specific needs and challenges of different faculty groups to enhance gender equality.

Nielsen [7, p. 18-20] examines the organizational implications of bibliometric measures for evaluating researchers' performance, highlighting potential gender biases. The study suggests that while bibliometric measures promote transparency and standardization, they may disadvantage candidates who deviate from the male scholarly norm. To address these biases, the study advocates for supplementing quantitative metrics with qualitative considerations, thereby ensuring a more holistic evaluation of candidates' contributions and potential.

Bjarnegård and Kenny [8, p. 386-387] assess the gendered nature of political party recruitment processes, emphasizing the importance of considering informal aspects of selection. While their findings provide valuable insights into gender dynamics in candidate selection, the relevance of these comparisons to academic recruitment processes is limited. The study underscores the need for collaborative research efforts to explore the gendered and informal dimensions of selection processes in different contexts.

Andersson, Hagberg, and Hägg [9] investigate gender bias in peer review processes at a Swedish institution, revealing that women with equal merits received lower scores than men. This finding highlights the need for quality-controlled recruitment and assessment processes to ensure equal opportunities for all candidates. The study suggests that implementing composite bibliometric scores and addressing biases in peer review processes are crucial steps towards fostering a true meritocracy in academia.

Picardi [10, p. 160] explores gender segregation in Italian academia, introducing the glass door index to quantify barriers faced by women. The study critiques the limitations of current comparative analyses and emphasizes the need to acknowledge the non-neutral nature of scientific excellence and meritocracy in academia. The findings suggest that standardized indicators may obscure the true evolution of gender composition in academia, highlighting the importance of developing more nuanced metrics to assess gender equality.
Khalil [11, p. 14] examines the impact of gender stereotypes and organizational culture on women's career advancement in Lebanese Higher Education Institutions. The study underscores the importance of workplace gender equality policies in mitigating discrimination and suggests quotas, training programs, and support for working mothers as potential solutions. However, the study's reliance on a single case study and small sample size limits the generalizability of its findings.

Tiainen and Berki [12, p. 178-179] focus on gender bias in the selection process for computer science professors in Finland. Their study reveals a pervasive male-dominant trend and highlights the need for organizational equality interventions, such as mentoring relationships and equal opportunity recruitment strategies, to counteract gender bias and promote female representation in academic positions.

Jeanrenaud, Müller, Borowski, Richert, Ihsen, and Jeschke [13] analyze structural and cultural factors influencing the representation of female professors in German academia. Their findings highlight the need for gender-sensitive and gender-neutral appointment methods and suggest training for all involved parties to address structural barriers and raise awareness of gender issues. The study advocates for sharing best practices among universities to promote equality in appointment processes.

Smith, Handley, Zale, Rushing, and Potvin [14, p. 1086-1087] implement a three-step intervention to increase the representation of women in STEM faculty roles. Their findings support ongoing initiatives aimed at achieving gender equality in STEM and highlight the importance of educating search committees about bias mitigation and providing recruitment tactics guides. The study underscores the need for interventions that foster competence, autonomy, and relatedness to enhance gender diversity in STEM faculties.

Checchi, Cicognani, and Kulic [15, p. 46] examine the influence of gender makeup in selection committees on women's participation in research roles. Their study suggests that the presence of a female member on the committee can mitigate bias against women in non-tenure track positions and highlights the importance of gender-neutral networks in promoting equality. The findings underscore the need for further investigation into promotion mechanisms and gender dynamics within organizational structures to address gender inequality in academia.

The reviewed literature provides valuable insights into various aspects of gender equality in university faculty candidate selection. However, there remains a need for comprehensive information and analytical systems to monitor and address gender equality in academia effectively. These systems should incorporate both quantitative and qualitative metrics, consider intersectional factors, and promote transparency and accountability in recruitment and selection processes. By leveraging such systems, universities can better identify and address biases, ultimately fostering a more inclusive and equitable academic environment.
The purpose of the article is to delve into the development and implementation of information and analytical systems designed to monitor and promote gender equality in the selection processes for university faculty candidates. By identifying and analyzing the key components necessary for an effective system, as well as the potential threats and measures to mitigate them, the article aims to provide a comprehensive understanding of how these systems can enhance fairness and diversity in academia.

Outline of the main material. Table 1 outlines the essential components of an effective information and analytical system designed to monitor and promote gender equality in university faculty candidate selection processes.

**Table 1.**

Key elements of information and analytical systems for monitoring gender equality in university faculty candidate selection

<table>
<thead>
<tr>
<th>Element</th>
<th>Definition</th>
<th>Key Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data collection and integration</td>
<td>Gathering and integrating data from various sources related to faculty candidate selection.</td>
<td>Aggregate data from application forms, HR databases, and departmental records. Ensure data consistency and accuracy. Facilitate comprehensive data analysis.</td>
</tr>
<tr>
<td>Gender equality metrics</td>
<td>Standardized measures to assess gender representation and equality in selection processes.</td>
<td>Develop and implement metrics such as gender ratios, hiring rates, and promotion rates. Monitor progress toward gender equality goals. Identify disparities.</td>
</tr>
<tr>
<td>Bias detection algorithms</td>
<td>Automated tools to identify and mitigate biases in candidate selection processes.</td>
<td>Analyze language in job advertisements and evaluations. Detect patterns of bias in hiring decisions. Provide recommendations to reduce bias.</td>
</tr>
<tr>
<td>Reporting and dashboards</td>
<td>Visual and interactive tools for presenting data and insights on gender equality.</td>
<td>Create real-time dashboards displaying key gender metrics. Generate reports for stakeholders. Highlight trends and areas needing improvement.</td>
</tr>
<tr>
<td>Candidate evaluation tools</td>
<td>Systems to ensure fair and unbiased evaluation of candidates.</td>
<td>Standardize evaluation criteria. Implement blind review processes. Provide structured feedback mechanisms.</td>
</tr>
<tr>
<td>Training and development modules</td>
<td>Educational resources for improving awareness and skills in promoting gender equality.</td>
<td>Offer training on unconscious bias. Develop modules on inclusive hiring practices. Facilitate workshops for search committees.</td>
</tr>
</tbody>
</table>
Compliance and monitoring mechanisms

Tools to ensure adherence to gender equality policies and regulations.

Track compliance with institutional and legal requirements.
Conduct regular audits of selection processes.
Provide alerts for non-compliance.

Feedback and continuous improvement systems

Mechanisms for collecting feedback and implementing improvements.

Collect feedback from candidates and faculty.
Analyze feedback to identify improvement areas.
Implement changes and monitor their impact.

Predictive analytics

Use of data analysis to forecast trends and outcomes in gender equality efforts.

Identify factors influencing gender disparities.
Predict the impact of policy changes.
Inform strategic planning and decision-making.

Stakeholder engagement platforms

Systems to engage and collaborate with stakeholders on gender equality initiatives.

Facilitate communication between administration, faculty, and external bodies.
Promote transparency and accountability.
Encourage collaborative initiatives.

Source: compiled by the author

Monitoring gender equality in university faculty candidate selection requires a comprehensive information and analytical system. The key elements of such a system include robust data collection and integration, standardized metrics, automated bias detection algorithms, visual and interactive reporting tools, fair candidate evaluation tools, education and awareness training, compliance and monitoring mechanisms, feedback and continuous improvement systems, predictive analytics, and stakeholder engagement platforms. Data collection and integration involve gathering data from various sources to create a comprehensive dataset, ensuring consistency and accuracy for reliable analysis. Standardized metrics, such as gender ratios, hiring rates, and promotion rates, help assess the current state of gender representation and track progress towards equality goals.

Automated bias detection algorithms analyze various aspects of the hiring process to identify and mitigate biases, such as biased language in job advertisements or evaluations. Visual and interactive reporting tools, like dashboards, present key gender metrics and generate detailed reports, fostering transparency and accountability. Fair candidate evaluation tools standardize evaluation criteria and implement processes like blind reviews to minimize biases, ensuring that candidates are judged solely on their merits. Education and awareness training modules provide resources to improve stakeholders' knowledge and skills in recognizing and combating bias, promoting a more equitable hiring environment.
Compliance and monitoring mechanisms track adherence to institutional and legal requirements, conducting regular audits and providing alerts for non-compliance. Feedback and continuous improvement systems gather input from candidates and faculty, allowing the institution to identify areas for improvement and implement effective changes. Predictive analytics use data analysis to forecast trends and outcomes related to gender equality efforts, helping institutions understand the potential impact of policy changes and proactively address issues. Stakeholder engagement platforms facilitate communication and collaboration between administration, faculty, and external bodies, encouraging participation and support for gender equality initiatives.

By integrating these elements, universities can gain a comprehensive understanding of their hiring practices, identify and mitigate biases, ensure fair and equitable candidate evaluation, promote awareness and compliance, and continuously improve their processes. Engaging stakeholders and leveraging predictive analytics further support strategic decision-making and drive meaningful change towards achieving gender equality in faculty selection.

Table 2 identifies key threats to information and analytical systems used in monitoring gender equality in the selection of university faculty candidates providing descriptions of these threats and suggesting measures to mitigate them.

<table>
<thead>
<tr>
<th>Threat</th>
<th>Description</th>
<th>Measures to tackle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data breach</td>
<td>Unauthorized access to sensitive candidate information.</td>
<td>Implement robust encryption, access controls, and regular security audits.</td>
</tr>
<tr>
<td>Biased algorithms</td>
<td>Machine learning algorithms that reflect existing biases in data.</td>
<td>Use diverse training datasets, regularly audit algorithms for bias, and employ fairness-aware ML techniques.</td>
</tr>
<tr>
<td>Incomplete data</td>
<td>Missing or incomplete candidate data leading to inaccurate analysis.</td>
<td>Ensure comprehensive data collection processes and use imputation techniques for missing data.</td>
</tr>
<tr>
<td>Human error</td>
<td>Mistakes in data entry or analysis by personnel.</td>
<td>Implement thorough training programs, double-check procedures, and automated error-checking tools.</td>
</tr>
<tr>
<td>Insider threats</td>
<td>Employees misusing access to manipulate data or analysis.</td>
<td>Conduct background checks, monitor user activities, and enforce strict access controls.</td>
</tr>
<tr>
<td>Cyber attacks</td>
<td>External attacks targeting the system to disrupt operations or steal data.</td>
<td>Deploy advanced cybersecurity measures, conduct regular penetration testing, and keep systems updated.</td>
</tr>
</tbody>
</table>
The monitoring of gender equality in university faculty candidate selection is crucial for promoting fairness and diversity in academia. However, there are several significant threats that can undermine the effectiveness of the information and analytical systems used for this purpose. These threats include data breaches, biased algorithms, incomplete or missing candidate data, human error, insider threats, cyber-attacks, inconsistent data formats and processes, resistance to adopting new monitoring systems, privacy concerns, and system outages or malfunctions.

Data breaches can lead to the exposure of personal and confidential data, harming individuals’ privacy and the institution’s reputation. Robust encryption, strict access controls, and regular security audits can help combat this threat. Biased algorithms can perpetuate gender disparities rather than mitigate them, necessitating the use of diverse training datasets, fairness-aware machine learning techniques, and regular algorithm audits for bias. Incomplete or missing candidate data can result in inaccurate analyses and flawed decision-making. Ensuring comprehensive data collection processes, employing techniques for imputing missing data, and continuously monitoring and updating data are essential. Human error in data entry or analysis can introduce inaccuracies, which can be mitigated through thorough training programs, double-check procedures, and automated error-checking tools.

Insider threats involve employees misusing their access to manipulate data or analyses. Conducting comprehensive background checks, monitoring user activities, and enforcing strict access controls can help prevent such threats. Cyber-attacks from external entities can disrupt operations or steal sensitive data, requiring advanced cybersecurity measures and regular penetration testing. Inconsistent data formats and processes across departments can hinder effective data analysis and monitoring. Developing and enforcing standardized data formats, policies, and procedures, along with regular training and communication, can facilitate smoother and more accurate data analysis. Resistance to adopting new monitoring systems can come from faculty or administration who are comfortable with existing processes.

The following table summarizes the key threats and suggested strategies:

<table>
<thead>
<tr>
<th>Threat</th>
<th>Description</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of standardization</td>
<td>Inconsistent data formats and processes across departments.</td>
<td>Develop and enforce standardized data formats, policies, and procedures.</td>
</tr>
<tr>
<td>Resistance to change</td>
<td>Faculty or administration reluctance to adopt new monitoring systems.</td>
<td>Conduct awareness programs, involve stakeholders in the design process, and demonstrate system benefits.</td>
</tr>
<tr>
<td>Privacy concerns</td>
<td>Concerns over the privacy of candidates’ personal information.</td>
<td>Adhere to data protection regulations, anonymize data, and ensure transparency in data usage policies.</td>
</tr>
<tr>
<td>Technical failures</td>
<td>System outages or malfunctions disrupting monitoring processes.</td>
<td>Implement redundant systems, regular maintenance schedules, and disaster recovery plans.</td>
</tr>
</tbody>
</table>

Source: compiled by the author
Conducting awareness programs and involving stakeholders in the design and implementation process can help overcome this resistance.

Privacy concerns over candidates’ personal information can arise when monitoring systems collect and analyze sensitive data. Adhering to data protection regulations, anonymizing data where possible, and ensuring transparency in data usage policies and practices can build trust among candidates and stakeholders. System outages or malfunctions can disrupt monitoring processes and lead to data loss or delays in analysis. Implementing redundant systems, regular maintenance schedules, and a robust disaster recovery plan can mitigate the impact of technical failures.

**Conclusions.** The implementation of information and analytical systems for monitoring gender equality in university faculty candidate selection is paramount for fostering fairness and diversity in academia. These systems, as outlined in Table 1, encompass essential elements such as data collection and integration, gender equality metrics, bias detection algorithms, reporting tools, candidate evaluation mechanisms, training modules, compliance monitoring, feedback systems, predictive analytics, and stakeholder engagement platforms. Each of these components plays a critical role in ensuring that the selection process is equitable and transparent.

The threats to these systems, as detailed in Table 2, highlight the vulnerabilities that can compromise their effectiveness. Data breaches, biased algorithms, incomplete data, human error, insider threats, cyber-attacks, lack of standardization, resistance to change, privacy concerns, and technical failures are all significant challenges that institutions must address. Effective measures, including robust encryption, diverse training datasets, comprehensive data collection, thorough training programs, strict access controls, advanced cybersecurity measures, standardized data formats, awareness programs, adherence to data protection regulations, and redundant systems, are essential to mitigate these threats and ensure the reliability and integrity of the monitoring systems.

Future research in this area should focus on developing more sophisticated and comprehensive bias detection algorithms that can adapt to new forms of bias as they emerge. Additionally, exploring advanced encryption methods and cybersecurity measures to protect sensitive data will be crucial as cyber threats continue to evolve. Research should also investigate the long-term effectiveness of training and development modules in changing behavior and promoting gender equality. Another promising area for future research is the integration of predictive analytics with machine learning techniques to forecast the impact of policy changes and identify potential disparities before they become problematic. This proactive approach can help institutions make data-driven decisions to promote gender equality more effectively.
References:
Література:


