Field of Study: Textile Engineering and Sustainable Technology

Title: **The Role of Industry 4.0 in Sustainable Transformation of Bangladesh's Textile Industry: A Stakeholder Perspective**

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Abstract:
Although one of the biggest contributors to the economy in Bangladesh, the textile industry faces an ever-increasing challenge of becoming more sustainable in terms of the environment. In that regard, this study argues about ways through which Industry 4.0 could make the industry sustainable. From the Bangladeshi textile sector, a total of 216 participants participated in the study, including manufacturers, designers, researchers, suppliers, and other important industry players. The few important aspects considered in the survey were: knowledge of Industry 4.0 technologies such as IoT, AI, Big Data, and Robotics; the extent of diffusion of these technologies within the respondents' organizations; how effective they feel these technologies are in reducing carbon emissions and improving the environment; and the main factors that help or hinder the adoption of these technologies. The survey also sought opinions from respondents on what incentives or mechanisms of support could help speed up the adoption of Industry 4.0 technologies in the textile sector. Descriptive statistics showed there was a significant relation between the role in the textile industry and knowledge of AI applications ($P < 0.007$) and between × Incentives/Support for Industry 4.0 and willingness to support AI-integrated sustainable brands ($P < 0.048$). Data was analyzed using SPSS software to help in establishing patterns of the respondents in terms of demographics and technology use. In the present study, various statistical methods were used, through cross-tabulations and Chi-square tests, to explore links between roles in the textile industry and perceptions related to the impacts of Industry 4.0. The regression analysis has been done for benefits, barriers, and incentives interrelated to one another. This paper provides insights on Industry 4.0 adoption in the Bangladeshi textile industry and highlights the main challenges hindering wider adoption, thus informing policymakers about necessary support for enabling the spread of these technologies. Targeted policies and support strategies are emphasized for realizing a long-term vision for a thriving, sustainable, and globally competitive Bangladeshi textile sector.

Keywords: Industry 4.0, Sustainability, Textile Manufacturing, Textile Waste Management, Artificial Intelligence (AI).