Industrial Robotic Machining: A Plan for the Procedures to be Used in a Survey Study

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Questions 1

Purpose and Rationale for the Survey Research

In the dynamic world of industrial manufacturing, robotic machining systems represent an integral transformative shift that can enhance efficiency, precision, and productivity. This research study delves into the advancements and challenges faced, particularly in this field, and this survey aims to gather valuable insights from professionals directly involved in or impacted by this industry. The participation of these stakeholders would be crucial in uncovering trends, challenges, and opportunities that will contribute to the knowledge base of this ever-evolving field. Confidentiality and anonymity are paramount; every response will be aggregated, ensuring that individual information remains confidential. Every candid feedback will be used solely for research and not disclosed to external entities.

Design Method to be Used

A cross-sectional design method will be used for this survey research. A cross-sectional design method allows for data collection from a more diverse sample of participants at a single point in time (Crewell, 2014). It will offer snapshots of the current practices as well as perceptions regarding the field of industrial robotic machining. Given the dynamic nature of technology adoption, this method will facilitate a quick and efficient assessment of the industry's standards, enabling timely insights into the challenges and advancements in robotic machining.

Population Targeted in the Survey Research

The survey will target professionals directly impacted by or engaged in industrial robotic machining across various sectors. The population will encompass individuals who

hold roles such as manufacturing engineers, production managers, and technicians with expertise in robotic machining technologies. Given the expansive nature of the industrial landscape, a stratified sampling method is the best approach. This ensures representation from various industry sectors, including the automotive, aerospace, and electronics industries. Stratification is also efficient as it allows for a more nuanced analysis, which will cover the unique challenges and advancements across each sector. The goal is to ensure a well-rounded understanding of the broader population and the inherent diversity of the industrial machining applications has been attained (Henningsen et al., 2017). This aspect will also enhance the survey's validity and provide insights tailored to specific industry standards.

Sample Size and Sampling Procedure

The sample size will be determined through the use of statistical considerations, and this is essential to ensure that a representative and reliable dataset has been attained. Since the population will be wide and diverse, this survey study will incorporate 100-150 individuals. The sample size will be determined through factors like the variability of the responses, the desired level of confidence, which is 95%, and an acceptable margin of error. With the sample size set, random sampling technique is employed to reduce bias and ensure study validity (Crewell, 2014). This will be based on subgroups from the industry sectors considered during the survey study. Random sampling with each stratum ensures a representation from each of these sectors and will provide a comprehensive perspective on industrial robotic machining advancements across various industries. This approach is essential in enhancing the survey's validity and maintaining the overall representative sample.

Instruments to be used in the Survey Study

The survey study will employ multiple instruments to gather comprehensive data on industrial machining robotic advancements. The first instrument that will be used is the

knowledge and experience questionnaire. The items in this instrument are approximately 10 questions that seek to assess the participant's knowledge and experience with industrial robotic machining. It will be adapted from validated measures used during the previous studies, and a pilot test will be used to test its reliability. Another instrument that will be used is the current practice survey. This instrument will cover 15 questions on the current use of robotic machining and the tasks that need to be automated. The survey will undergo a pilot test to assess its reliability, and the validity of the content will be drawn from consulting experts in the robotic machining industry (Henningsen et al., 2017). A challenges and barrier inventory will also be used in the survey study. Ten questions that identify challenges and barriers faced in implementing robotic machining will be used, and the inventory will be constructed using the available literature and pilot-tested for validity.

Pilot Testing Procedure and Timeline for the Study

The pilot testing will involve a small group of diverse participants representative of the target population. They will complete the survey instruments and feedback on clarity, relevance, and potential issues that will be collected through interviews and feedback forms. Adjustments will be made based on this input to enhance the survey's reliability and efficiency. The timeline for administering the survey will include a two-week pilot testing phase, which will ensure sufficient feedback as well as revisions. The main survey will be distributed over two weeks, allowing ample time for the participants to adhere to the project's guidelines.

Measures, Variables, and Scores

Survey measures will be scored using the standardized approach. Variables like "technology adoption" or "Challenges faced" will be derived from aggregating the relevant scores. Statistical analysis methods such as regression will be employed to test the research

questions (Fogli & Herkenhoff, 2018). For example, technology adoption scores may be correlated with performance variables to assess the impact. This structured approach ensures a quantitative evaluation of relationships between variables, providing insights into the factors influencing industrial robotic machining.

Data Analysis

The data analysis will commence with returns analysis to ensure completeness and accuracy. To analyze the returns the survey responses will be input into a structured database and the data will be checked for missing or incomplete responses. A check for response bias will be performed to identify and address any systemic patterns and this will be done by analyzing the response rates across all the participants if certain findings are excluded then it could signal a potential bias. A descriptive analysis will summarize key findings and this will be achieved by calculating measures like range, variation, and standard deviation to assess the spread of variability within the data. Items will then be combined into scales by identifying conceptual themes and constructs within the data and their reliability will be assessed using appropriate statistical measures like conduct factor analysis which checks the underlying structure of the scales and confirmation of the items' groupings. Inferential statistics like regression or ANOVA will be employed to test the hypothesis (Creswell, 2014).

Result Interpretation

Finally, the results will be interpreted through methods such as comparison of the findings with the stated hypothesis as well as examining the patterns and trends within the data, providing meaningful insights into the relationships between variables and contributing to the industry's comprehensive understanding of industrial robotic machining advancements.

References

Creswell, J. W. & Creswell, D. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches*. 5th edn. SAGE.

Fogli, J., & Herkenhoff, L. (2018). *Conducting survey research: A practical guide*.

Henningsen, I., Steffensen, T., & Christensen, H. R. (2017). Quantitative methodologies and big data. *Kvinder, Køn & Forskning*, (1). https://doi.org/10.7146/kkf.v26i1.97083.