

THE ANTECEDENTS AND OUTCOMES OF AI ADOPTION IN SMEs

INTRODUCTION

In today's high-paced economic environment, firms have identified organizational innovation not only as a desired element for growth (Damanpour, 1991; Hsueh, Lin, & Li, 2010; Hurley & Hult, 1998), but increasingly a necessary factor for survival (Audretsch, 1995; Cefis & Marsili, 2005). As innovation spans from the development of new products (Peres, Muller, & Mahajan, 2010) over services (Djellal, Gallouj, & Miles) to business processes (Papinniemi, 1999), and administrative systems (e.g. see Lin & Chen, 2007), it provides organizations with the ability to advance performance, resolve complications, add value and create competitive advantage (Gloet & Terziovski, 2004).

While there is currently no consensus in literature about what the term Artificial Intelligence (AI) precisely means, it can be defined as “collective term for computer systems that can sense their environment, think, learn, and take actions in response to what they are sensing and their objectives“ (Rao & Verweij, 2017, p.0). As such AI may turn out to become one of the most important innovations of our lifetime: It is expected to reshape human society (Hawking, Russell, Tegmark, & Wilczek, 2014) and specifically also business (Dirican, 2015). Due to the expected magnitude of the transformation some authors even go as far to label this process the “AI revolution” (Levy, 2010; Makridakis, 2017; Urban, 2015).

Consequently numerous scholars (Brynjolfsson, Rock, & Syverson, 2018; Masayuki, 2016) as well as practitioners (Bughin et al., 2017; Purdy & Daugherty, 2017; Rao & Verweij, 2017) have set out to study this phenomenon and its potential impacts on corporations in greater detail. What is striking, however, is that most of these works implicitly or even explicitly restrict themselves to large companies and thus exclude small and medium sized enterprises (SMEs). Numerous studies from the field of innovation have yielded evidence that

SMEs typically behave significantly different from large corporations when it comes to innovation and new technology adoption (Buonanno et al., 2005; Hoffman, Parejo, Bessant, & Perren, 1998; Rothwell & Zegveld, 1982; Terziovski, 2010). We therefore investigate this phenomenon specifically in an SME setting.

Understanding what drives AI will become paramount to an increasing number of firms. Moreover, gaining a deeper understanding of the relationships between SME attributes on the one hand and AI adoption on the other may yield hands-on advice on how enterprises could enhance their innovation capabilities. From a theoretical perspective the applicability of AI to SMEs has been a largely underresearched topic. With this paper we want to address this void in literature. The purpose of this study is therefore to describe and better understand the artificial intelligence landscape among the Swiss SMEs as well as provide recommendations for practitioners.

THEORETICAL FRAMEWORK

Although useful, prior research attempting to explain the antecedents of technology adoption does not comprehensively describe the phenomenon investigated in this paper. The investigation into the antecedents of AI adoption in SMEs innovation performance unfolds in the next section along the three hypothesized relationships in the model.

First, grounded in organizational behavior theory we describe the effects that organizational smallness may have on the perceived importance of AI among SMEs. Second, we assess the potential influences organizational size the estimated impact of AI for SMEs. In a later stage, it is discussed how perceived importance and estimated impact effects the technology strategy of an SME.

A model of the antecedents of AI adoption in SMEs as explained herein is presented in Figure 1.

Insert Figure 1 about here

This model rests on the following three hypotheses derived from organizational behavior theory:

H₁: The larger an SME, the higher the perceived importance of AI

H₂: The larger an SME, the larger is the estimated impact of AI

H₃: The larger the perceived relevance of AI is, the more likely is the firm to have an adoption strategy for new technologies

RESEARCH METHODOLOGY

We relied on a quantitative research design to gather empirical evidence and address the validity of the relationships suggested in research model derived above. Consequently, a dedicated structured survey was carried out among 1000 Swiss SMEs between June and July 2018 of which we obtained a total of 128 useable responses.

Measures

The estimated impact of AI was polled using a five point likert scale question: to which degree do you will AI affect your industry sector by 2022? The respondents were asked to choose among responses from «not at all» to «to a very high degree».

Also, the perceived importance of AI was captured using a five point likert scale question. The respondent was asked about the relevance of the AI for the company and could choose among responses from «not relevant at all» to «highly relevant».

Information on adopting a new technology strategy was gathered using a dichotomous question, asking whether the company has already implemented a new technology adoption strategy: yes/no.

ANALYSIS AND RESULTS

Data Analysis

As best suitable for the variables measured, an ANOVA test, a Chi Square test and a t-test were conducted. The null hypothesis of every test stated therefore that there was no relationship between the two measured phenomena.

The ANOVA test for Hypothesis 1 yielded an f-ratio value of 6.0781, and a corresponding p-value of 0.003111. Hence, the results are significant at a level of $p < 0.01$. We therefore see statistical support for H1: The larger the firm is, the greater it perceives the importance of AI.

The Chi-Square value for testing Hypothesis 2 was 6.43 and the corresponding p-value 0.04, hence yielding results as significant at $p < 0.05$. Hypothesis 2 was therefore supported.

A Student t-test was conducted for Hypothesis 3 was conducted. The statistical analysis yielded a t-value of 6.54 and a p-value of < 0.00001 , rendering the result significant at $p < 0.01$ level. We therefore see evidence for the affirmation of H3: The larger the perceived relevance of AI is, the more likely is the firm to have an adoption strategy for new technologies

DISCUSSION OF FINDINGS

This research yields three contributions. First, we provided testable hypotheses that advance entrepreneurship theory in the context of new technology adoption. We have developed a model of the antecedents and outcomes of AI adoption in SMEs. Second, we

quantitatively assess the effects of firm size on the perceived importance of AI in SMEs and the estimated impact SMEs attribute to AI. Third, we tested for linkages to the existence of a technology adoption strategy in the organization.

Implications for Theory

Our paper is the first identifiable study specifically investigating AI in the context of SMEs. It offers two implications for theory. First, as size matters, this study suggests applying an SME-specific perspective to assess the antecedents of AI adoption. Previous research suggests that SMEs adapt more flexibly their organizational routines and keep closer linkages with clients, yielding more learning opportunities (Argyris & Schon, 1996; Nonaka & Takeuchi, 1995; Senge, Kleiner, Roberts, Ross, & Smith, 1997). Hence, smaller firms should have an advantage over larger firms when it comes to perceiving and interpreting the significance of new technologies. Yet, our findings do not corroborate this notion. On the contrary, the perceived importance of AI and the estimated impact increased with firm size.

Second, the present study is the first paper that suggests a significant linkage between size and the AI adoption. Being aware of this potential relationship is important because it may eventually lead to further empirical evidence that provides scientific insights on the phenomenon of technology adoption as a whole.

Implications for Practice

Our model provides insight into some key contingencies that potentially affect the adoption of AI in SMEs. We suggest that managers who seek to implement AI in their firm should first and foremost provide the necessary resources to conduct an ongoing scan of the organizational environment to identify chances and risks posed by AI and to be able to correctly assess the ramifications of this new technology. If managed rightly, these measures can yield significantly higher AI adoption levels for the firm.

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Figure 1: A model of the antecedents and outcomes of AI adoption in SMEs

