# THE PROMISES AND PERILS OF APPLYING ARTIFICIAL INTELLIGENCE FOR SOCIAL GOOD IN ENTREPRENEURSHIP

A Study by the Alexander von Humboldt
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Artificial intelligence (AI) is viewed as a new breeding ground for unprecedented entrepreneurial opportunities. While researchers and practitioners alike agree that AI holds great potential for economic growth, one key question that arises is: How can AI be applied for the greater good of society? In this study, we explore how entrepreneurial ventures apply AI for social good. Our findings reveal four promises and perils that arise when applying AI for social good, and we offer four key takeaways for entrepreneurs who are interested in using AI to create positive societal impact. We also note implications for policy makers.

Alexander von Humboldt
INSTITUTE FOR INTERNET
AND SOCIETY

# FOREWORD

For more than a decade, the Alexander von Humboldt Institute for Internet and Society (HIIG) has been dedicated to researching digitalization and its impact from a societal perspective. During this time, we have witnessed substantial technological advances in diverse fields such as computer vision, machine learning, and pattern recognition, which are often subsumed under the term "artificial intelligence." At the same time, the need to tackle societal grand challenges such as climate change has become ever more urgent. Given the technological affordances of AI, the question of how it can be applied to address such challenges is becoming increasingly relevant.

**THE AUTHORS PROVIDE GUIDANCE TO ENTREPRENEURS WHO ARE INTERESTED IN APPLYING AI FOR THE GREATER GOOD OF SOCIETY**

The present study considers this question in the realm of entrepreneurship. It is based on qualitative interviews with 15 founders and managers who apply AI to address a variety of societal problems. The authors identify opportunities and challenges that arise in the process and provide guidance to entrepreneurs who are interested in applying AI for the greater good of society. The study therefore helps to answer the question of whether and how AI could be used by entrepreneurs as a tool to benefit society.

Prof. Dr. Dr. Thomas Schildhauer, HIIG director

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# INTRODUCTION

How can AI be applied for the
greater good of society?

As a core element of the "fourth industrial revolution," AI is increasingly being embraced by companies, governments, and communities of practice (Schwab 2017). In the last few years, it has been applied within diverse industries (e.g., health care, banking, education, manufacturing, retail) and business realms (e.g., supply chains, customer relations, production processes) (Lévesque et al. 2020). Understood as the performance by a machine of cognitive functions usually associated with the human mind (Raisch & Krakowski 2021; see also Nilsson 1971), AI encompasses fields such as computer vision, natural language processing, and pattern recognition (Jarrahi 2018). As a highly capable and complex technology, AI is expected to generate great numbers of innovations, which may make AI an instigator, facilitator, and new breeding ground for an unprecedented level of entrepreneurial opportunities (Kabir 2018).

In addition to its potential for economic growth (e.g., Makridakis 2017), AI may also positively impact societal change. For instance, practitioners have suggested that AI could contribute to the multi-pronged efforts to tackle some of the world's most challenging societal problems—after all, it is already being leveraged in research to tackle "moon shot" challenges such as curing cancer and preventing climate change (McKinsey & Company 2018: 3).

Similarly, researchers have argued that, assuming ethical and organizational challenges are sufficiently addressed, AI-based technologies may contribute to alleviating societal problems in various domains, including equality and inclusion; education, health, and hunger; or climate action (e.g., Tomašev et al. 2020).[1]

In these domains, entrepreneurial ventures are widely known as contributors to the greater good of society. In particular, research suggests that they can create and pursue social innovation to catalyze systemic change and scale solutions to maximize impact (Mair et al. 2012; Wry & Haugh 2018). In this process, technology often plays a pivotal role (Westley & Antadze 2010), with entrepreneurial ventures seeking to unlock the potential of AI as the newest frontier in technological progress (DSEM 2021). One important question that arises in this regard is: How can AI be applied for the greater good of society and what are the promises and perils that arise in this process?

**ASSUMING ETHICAL AND ORGANIZATIONAL CHALLENGES ARE SUFFICIENTLY ADDRESSED, AI-BASED TECHNOLOGIES MAY CONTRIBUTE TO ALLEVIATING SOCIETAL PROBLEMS IN VARIOUS DOMAINS**



1 Note that the use of AI will not inevitably benefit society. In the world of work, for example, AI enables companies to adopt new and problematic instruments of control (Kellogg et al., 2020). While we are aware of the potentially harmful effects of the use of AI, this article focuses on how entrepreneurial ventures can apply AI for the greater good of society.

To answer this question, we interviewed the founders and managers of 15 entrepreneurial ventures. Exploring how they apply AI for social good, our findings reveal four main promises and perils: While we find that venturing with AI for social good holds the promise of stakeholder engagement, structural flexibility, breakthrough progress, and customization at scale, it also poses challenges of how to deal with systemic bias, the black-box problem, scarce technological skills, and difficult-to-measure outcomes. We conclude our study by discussing four takeaways for entrepreneurs who are interested in leveraging AI for social good, namely, overcome the trust gap, manage resource scarcity, engage in holistic venturing, and create large-scale impact.

This study proceeds as follows. First, we provide a brief review of the literature on AI and on entrepreneurial ventures as contributors to the greater good of society. Next, we explain the methods and describe the promises and perils identified in the findings section. The study concludes with implications for entrepreneurs and policy makers.

# THEORETICAL BACKGROUND

Entrepreneurial ventures and societal advancement

## THEORETICAL BACKGROUND

### AI as a new era in technology

AI is a highly capable and complex technology (Glikson & Woolley 2020) that consists of a heterogeneous set of tools, techniques, and algorithms with various applications, ranging from robotics to natural language processing to the recognition of speech, patterns, and objects. Unlike traditional computer programs, which have a fixed set of preprogrammed instructions, AI can learn and therefore improve and adapt based on experience (Chalmers et al. 2021). As a new generation of technology, it also interacts with the environment by (a) gathering information; (b) interpreting this information, recognizing patterns, and predicting events; (c) generating results, answering questions, or giving instructions; and (d) evaluating the results of actions and improving decisions to achieve specific objectives (Ferràs-Hernández 2018; Glikson & Woolley 2020). Hence, AI shifts agency and control from humans to technology, thereby recasting the role of technology in society and transforming our understanding of human-technology relations (Glikson & Woolley 2020).

In terms of entrepreneurial activity, there is ample evidence that AI is an especially fashionable and dynamic area, with significant venture capital flowing to AI start-ups (OECD 2018). It is regarded as a growth area by both the private and public sectors (AppliedAI 2019), and, hence, many corporations and governments are increasingly supporting this new field by investing their funds and launching communities of practice where innovative start-ups can develop and experiment with AI-based technologies. Yet, the impetus of these initiatives is primarily centered on technological progress and *not* on societal advancement (Gregory et al. 2021; Raisch & Krakowski 2021).



### Entrepreneurial ventures as contributors to the greater good of society

Over the last decades, entrepreneurial ventures have been acknowledged as key contributors to the greater good of society as they offer novel solutions to severe problems such as poverty, inequality, pandemics, and climate change (Dacin et al. 2011; Günzel-Jensen et al. 2020, Scheidgen et al., 2021). Scholars have found that entrepreneurial ventures, understood as organizations that "leverage economic activity to pursue a social objective" (Mair et al. 2012: p. 353), catalyze positive change and scale solutions to maximize their impact (Ebrahim & Rangan 2014; Siebold et al. 2019). Entrepreneurs pursuing social objectives are increasingly recognizing the importance of technology, which often plays a pivotal role in their venturing (Westley & Antadze 2010).

In terms of societal advancement, previous research has found that AI technologies are affecting decision making in areas including education, employment, health care, immigration, and criminal justice, with companies and governments increasingly utilizing the distinct capabilities of AI (Henriksen & Bechmann 2020; Lévesque et al. 2020).

Indeed, pioneering studies have indicated that the use of AI could have implications for social equality and fairness in employment and criminal justice cases—automation can reduce humans' implicit bias (Daugherty & Wilson 2018). Yet, while AI may lead to social good or be utilized by socially oriented entrepreneurs looking for new ways to benefit society, the entrepreneurship literature to date does not shed sufficient light on how entrepreneurial ventures can apply AI for the greater good of society and on the promises and perils that arise in doing so.

**THE ENTREPRENEURSHIP LITERATURE TO DATE DOES NOT SHED SUFFICIENT LIGHT ON HOW ENTREPRENEURIAL VENTURES CAN APPLY AI FOR THE GREATER GOOD OF SOCIETY**

# METHODS

A multiple case study of entrepreneurial ventures
that apply AI for the greater good of society

As there is a lack of theoretical and empirical research on how entrepreneurial ventures apply AI for the greater good of society and the promises and perils that may consequently arise, we conducted an inductive, in-depth, multiple case study (Eisenhardt et al. 2016). This enabled us to investigate a "contemporary phenomenon within its real-life context" (Yin 1994: 13) while facilitating cross-case comparisons. Our study is based on 15 semi-structured in-depth interviews with founders and managers of entrepreneurial ventures that apply AI technologies and thereby aim to tackle societal grand challenges such as climate change, inequality, and sustainable consumption. The interviews started with broad questions to understand the interviewee's role within the organization and their use of AI technologies. Interviewees were also asked to reflect on the perceived benefits of using AI technologies, with a special focus on the organization, its clients, and society. Table 1 provides an overview of the 15 entrepreneurial ventures, a brief description of their AI-based activities, and information on the interviewee's role and the industry and country where the venture is located. The interviews were complemented with archive material, which included internal and external documents, such as company presentations and notes, website content, and blog articles.

The data analysis included an in-depth analysis of the ventures and the promises and perils that the interviewees experienced when applying AI technologies. In the findings section, we will focus on the four main promises and perils that emerged from our inductive data analysis.



## HOW DO COMPANIES USING AI TECHNOLOGIES TACKLE GRAND SOCIETAL CHALLENGES?

| VENTURE | BRIEF DESCRIPTION | INTERVIEWEE | INDUSTRY | COUNTRY |
|---|---|---|---|---|
| | Entrepreneurial venture that... | | | |
| 1 | ... uses object detection and localization to identify and remove small trash with autonomous robots. | Founder | Environmental services | Germany |
| 2 | ... plans to use deep learning on structured data to implement a digital reusable bowl-system for takeout, delivery, and convenience food. | Founder | Environmental services | Germany |
| 3 | ... uses deep learning on structured data to assess the short and long-term climate risks of assets. | Founder | Environmental services | United Kingdom |
| 4 | ... uses image recognition and classification as well as object detection and localization to identify, categorize, and map plastic waste. | Founder | Environmental services | United Kingdom |
| 5 | ... uses image recognition and classification as well as object detection and localization to monitor trees and forests in order to assess the risks of forest fires and power outages. | Founder | Electric utilities and forestry | Netherlands |
| 6 | ... uses image recognition and classification to monitor beehives and collect data in order to investigate the causes of insect death. | Founder | Agriculture | Germany |
| 7 | ... provides a mobile app to farmers in developing countries and uses image recognition and classification to detect plant diseases, pests, and soil deficiencies. | Operations Manager | Agriculture | Germany |
| 8 | ... offers a mobile app and uses natural language processing and analytics to assess chronic gastrointestinal issues and provide personalized digital care. | Founder | Health care | Germany |
| 9 | ... uses image recognition and classification to analyze anti-microbial images of patients in developing countries in order to support diagnoses and provide patient treatment. | Director | Health care | France |
| 10 | ... uses image recognition and classification to digitalize medical images and develop applications for medical analysis and diagnosis. | Founder | Health care | Spain |
| 11 | ... offers a mobile app and uses natural language processing to assess the skills of marginalized people and connect their skills to local job occupations. | Founder | Education | Netherlands |
| 12 | ... uses deep learning on structured data to analyze payment transactions in order to provide purchase information and external environmental data to its clients. | Founder | Banking | Germany |
| 13 | ... uses natural language processing to provide live-messaging conversational automation. | Founder | Customer service | Germany |
| 14 | ... uses deep learning on structured data in order to provide an open-source standard on data application for sustainable consumption. | Founder | Customer service | Germany |
| 15 | ... uses image recognition and classification to identify and track food waste in restaurants. | Founder | Hospitality | Netherlands |

# FINDINGS

The promises and perils of applying AI
for social good in entrepreneurship

## PROMISES

Stakeholder engagement

Structural flexibility

Break-through progress

Customization at scale

## PERILS

Systemic bias

Black box problem


Scarce technological skills


Difficult-to-measure outcomes

## THE PROMISES OF VENTURING WITH AI FOR SOCIAL GOOD

Our analysis reveals four main promises and perils of venturing with AI for social good (see the illustration on page 15).

### STRUCTURAL FLEXIBILITY ENABLED ENTREPRENEURIAL VENTURES USING AI TECHNOLOGIES TO CHALLENGE THE TAKEN-FOR-GRANTED IDEALS AND PRACTICES OF TECHNOLOGY STARTUPS

Our study identifies four notable promises: (1) stakeholder engagement in cross-sector collaborations built upon shared societal goals; (2) the ventures' structural flexibility in making use of for-profit and not-for-profit organizational forms; (3) break-through progress made possible by AI technology; (4) and the ability to provide customization at scale. The first promise, *stakeholder engagement*, was evident in many interviews and concerned beneficial collaborations with heterogeneous stakeholders from both the public and private sector. Because the ventures we analyzed focused on social good and common objectives (e.g., reduction of plastic waste), they had the ability to approach different types of stakeholders, such as NGOs, government agencies, corporate clients and, in some cases, even competitors and companies that were considered partly responsible for the societal issues tackled (e.g., suppliers of plastic packaging).

The use of AI offered these ventures reliable insights for their stakeholders—this applied to entrepreneurial venture 4 (EV4), which provided AI-based data analysis that was used as evidence to inform policy makers' decisions and thus drive legislative change in the form of a ban on single-use plastic packaging. By mobilizing public- and private-sector organizations to engage collectively, EV4 received support that varied from financial contributions to knowledge provision. This helped the founders to further develop AI technologies. At the same time, EV4 engaged with research communities (e.g., universities, government laboratories, institutes, and research arms of technology companies), who became active stakeholders who make use of for-profit, not-for-profit, and hybrid structures.

The second promise, *structural flexibility*, describes the ventures' flexibility to make use of for-profit, not-for-profit, and hybrid structures. This meant that they were in a unique position to act as a bridge between communities that were interested in either technological or societal advancement. In the case of entrepreneurial venture 14 (EV14), the two arms of the venture allowed it to simultaneously offer free scientific advancement regarding how to calculate sustainability via its not-for-profit arm while also offering its AI capabilities on a for-profit basis to banks interested in measuring their clients' consumption footprint. As such, this structural flexibility allowed EV14 to capture and redistribute revenues via its dual for-profit/not-for-profit entities with distinct legal forms. The structural flexibility of the entrepreneurial ventures using AI also enabled them to question the taken-for-granted ideals and practices of technology startups. This involved prioritizing societal impact over exponential growth and profit and seeing AI as a means to an end (social advancement) rather than an end in itself.

The third promise, *break-through progress*, was reflected upon by many interviewees. It concerns the discontinuous technological nature of AI and how it can accomplish tasks beyond traditional human abilities. An example of a venture in which AI afforded radical new approaches that transcend traditional organizational outcomes is entrepreneurial venture 11 (EV11), which used neural networks to build a precise skill profile

for marginalized individuals, such as refugees coming from Syria to Europe. The founder's belief that AI offered innovative ways to perform organizational activities and obtain novel outcomes that can lead to break-through progress was central to many of the cases we studied. All but two of our interviewees acknowledged the potential "quantum nature" of improvements that AI yields in producing previously unattainable organizational outcomes.

The fourth promise, *customization at scale*, was evident when the ventures were able to deliver a service or product that was highly customized to each individual client's need without incurring high costs. For example, entrepreneurial ventures 13 (EV13) achieved customization at scale using chatbots that engaged with each client in a unique manner and provided individualized outputs without incurring the costs expected when maintaining a large number of customer service employees. In this way, AI promises to transcend traditional trade-offs between differentiation and cost strategies. Our analysis indicates that customization at scale may initiate a shift from a variable cost-driven business model to one that is based on front-end fixed costs, such as building and training AI systems; the venture hence benefits from economies of scale while maintaining high-levels of individualized outputs.



## THE PERILS OF VENTURING WITH AI FOR SOCIAL GOOD

Our study reveals that the founders must also contend with four main perils: (1) the risk of introducing systematic bias into AI systems; (2) the black-box problem of having nonhuman systems make opaque decisions that ultimately affect humans; (3) competing for scarce technological skills; (4) and providing difficult-to-measure outcomes that relate to its focus on the social good. The first peril, *systematic bias*, concerns prejudices that are designed into the AI system, for example, due to bias in the data sets that are used to train AI models. For instance, the data sets collected and used to train AI models at entrepreneurial venture 9 and 10 (EV9 and EV10) mainly included North American and European medical images, yet these were not representative of the type of client-beneficiaries the organizations were trying to help (i.e., patients in developing countries). The bias towards providing better care to U.S. and European types of patients generated an imbalance in the digital libraries available to AI researchers. At the same time, training new AI models using existing knowledge and past experience risked introducing systematic design bias into the calibration of the neural network, which occurred in the case of entrepreneurial venture 11 (EV11)—this venture used existing human resources data that, from the founder's perspective, risked engendering the same bias (e.g., race, age, religion) that exists in the labor market and that largely causes the inequality that the venture is trying to fight.

The second peril, the *black-box problem*, arises when AI systems run in deep neural networks that use different layers of computing to answer questions via backward propagation, a technique that essentially represents how machine learning unfolds. This peril relates to not knowing how the system arrives at conclusions, which is especially critical for human-related applications in areas such as health care, employment, or criminal justice. In the case of entrepreneurial venture 8 (EV8), a venture that assessed chronic gastrointestinal issues and

provided personalized digital care to its users, this peril pertained to the difficulty of trusting an AI that was built and trained but whose diagnostic decisions cannot be fully explained. Given that founders followed the precautionary principle, we find that the black-box problem limited many of them in terms of the areas where they deployed AI and the activities they undertook using AI.

## SECURING TECHNOLOGICAL SKILLS THAT ARE HIGHLY IN DEMAND IN BOTH THE PRIVATE AND PUBLIC SECTOR CAN BE EXTREMELY CHALLENGING

The third peril, *scarce technological skills*, was pointed out by many interviewees, who reported that it was extremely difficult to secure technological skills that are highly in demand in both the private and public sector. In particular, the interviewees explained that they needed people with strong scientific, mathematical, and engineering knowledge in order to build and continuously develop AI technologies. For instance, the founder of EV11 reported that they needed neural network scientists who were highly qualified—such candidates often held master's or Ph.D. degrees and had both broad procedural computing knowledge and a deep theoretical understanding of the mathematical constructs underpinning AI. Individuals with such skills are rare and difficult to retain, as newly established ventures often cannot afford to pay market-based competitive salaries for engineers, who end up working for leading technology companies such as Alphabet, Apple, Facebook, Amazon, Tencent, and Microsoft.

The fourth peril, *difficult-to-measure outcomes*, emerged in many interviews and and refers to venturing activities that mostly generate indirect outcomes for the ventures' main client groups. For instance, the founder of EV11, a venture that used natural language processing to help marginalized people to assess their skill level and helped them to get jobs appropriate to their skills, stated that the venture's activities *indirectly* improved living standards. While many of the interviewees said that they could see the outcomes of their activities, they reported not currently being able to measure them. In some cases, this difficulty in measuring outcomes was due to the ventures' focus on preventing certain events, such as insect mortality or plant diseases. In the case of EV13, a venture that used natural language processing to create chatbots for its clients' customer-service activities, the founder saw the opportunity to apply the chatbots in support of marginalized families. While the societal value of such activities appeared evident, the founder noted challenges in finding a path to monetization, which made it difficult to apply them in service of marginalized families.

# IMPLICATIONS

Takeaways for entrepreneurs and policy makers


Overcoming the trust gap
Managing resource scarcity
SOCIAL GOOD
Creating large-scale impact
Engaging in holistic venturing

## IMPLICATIONS FOR ENTREPRENEURS

For entrepreneurs, there are four key takeaways from our findings that can help them to leverage AI for social good (see the illustration on page 20).

One implication of our findings is that entrepreneurs need to *overcome a trust gap* as they contend with systematic bias and use systems affected by the black-box problem while aiming to deliver difficult-to-measure outcomes. While prior research has shown how mistrust in AI is driven by the sense that machines may soon replace humans and lead to work displacement (Kabir 2018), our study reveals an issue of trust that relates to the design and functionality of AI and its ethical and moral implications. Although AI enables ventures to achieve impressive levels of people-centeredness (Verganti et al. 2020), it does so without providing transparency on how decisions are being made, thus acting as a black box. In the case of EV11, it has prompted the founder to shy away from formulating life-altering recommendations about education and jobs, which could potentially be invaluable to its clients. Instead, the venture leveraged AI for descriptive purposes and mixed in more traditional mathematical models and human experience in order to make client recommendations. Because AI systems are inherently agnostic about ethics and morality, overcoming the trust gap represents a significant task for entrepreneurs who use them to interact with vulnerable humans or make diagnostics and recommend health treatments.

A second implication of our finding is that entrepreneurs also need to *manage resource scarcity* as they face the challenge of securing scarce technological skills to deliver their difficult-to-measure outcomes. While the fact that technological skills are in high demand and entrepreneurs are struggling to recruit people with the right mix of technical and mathematical knowledge is unsurprising, the high salaries paid by leading technology companies make it even more difficult for nascent entrepreneurs from small and medium-sized enterprises of all kinds to build a team with requisite skills (Cheng 2018). For entrepreneurial ventures that focus on using AI for social good, this problem is even more acute. In the case of EV11, engineers were offered shares in the company to compensate for lower salaries. Such strategies may help to manage resource scarcity in for-profit ventures with founders who have a proven performance track record. However, for new ventures aiming at difficult-to-assess or benefiting-the-commons outcomes, an equity-driven solution may prove impractical. In the case of entrepreneurial venture 6 (EV6), the venture's goal of protecting biodiversity and combatting bee mortality, while likely vital for our own survival, leads to outcomes that are difficult to measure and thus monetize.

Hence, its founder heavily relied on ad-hoc donations from like-minded stakeholders to ensure the venture had sufficient funding for its activities. Likewise, EV9 relied on external support from Alphabet, despite being an affiliate of a global nonprofit organization with size, brand recognition, and a wealth of experience. While such third-party support helps to mitigate resource scarcity, it falls short of a perennial strategy for scaling, and it may prevent entrepreneurial ventures from significantly contributing to the development of AI (Chalmers et al. 2021). As such, in order to participate in the disruptive development of AI and apply it for social good, resource scarcity needs to be managed well.

A third takeaway from our analysis is that entrepreneurs can *engage in holistic venturing* when they leverage structural flexibility to collaborate

with multiple stakeholders from the for-profit and nonprofit sectors. Our analysis indicates that this truly presents a substantial source of potential for ventures using AI for social good, as they focus on problems that need to be solved holistically. Hence, entrepreneurial venture 3 (EV3) can monetize its capabilities when dealing with banks and insurance agencies while also allowing individuals and research communities to access its data for free. When they utilize multiple legal forms, entrepreneurs can capture and redistribute revenues under for-profit and not-for-profit structures. This allows innovation to flourish, not only to maximize profits but also to service marginalized stakeholder and client groups with limited resources (Pappas & Popescu-Belis 2017). It is notable that holistic venturing does not just benefit entrepreneurial ventures and the grand challenges they aspire to address but all of the stakeholders involved. AI researchers may particularly benefit from data access and the opportunity to develop, test, and refine their models in real-life contexts.

### LEVERAGING STRUCTURAL FLEXIBILITY TO COLLABORATE WITH CROSS-SECTOR STAKEHOLDERS ENABLES HOLISTIC VENTURING

Finally, entrepreneurs can leverage the affordances of AI to create *large-scale impact* through break-through progress, customization at scale, or a combination of both. Past studies have documented how AI changes the fundamental characteristics of businesses, recasting the need to mitigate traditional limitations such as scale, scope, and learning (Vertangi et al. 2020). More specifically, the self-learning nature of AI systems (Faraj et al. 2018) enables entrepreneurs to find novel solutions to address society's grand challenges. Our study indicates that this often involves innovative ways of monitoring, understanding, and predicting developments. These data-based insights in turn can be used by entrepreneurs and collaborators to design effective interventions.

For example, entrepreneurial venture 5 (EV5) used AI to monitor trees and forests so that it could assess the risk of forest fires and power outages. Moreover, when customization at scale is enabled by the greater use of machines, this means that ventures do not need to shoulder the greater costs that are traditionally associated with serving more clients. As in the case of EV3, once the rules had been defined and the AI engine was calibrated using machine-learning protocols, multiple risks—ranging from forest fires, floods, and other extreme weather events—could be identified, with immediate implications for all asset categories around the world. As such, the level of analysis is no longer subject to the number of assets being evaluated for risk, independent of the number of analysts involved in the effort.



## IMPLICATIONS FOR POLICY MAKERS

Our study suggests that policy makers have a stake in developing AI for social good. As we contemplate the fourth industrial revolution (Schwab 2017), we see that it has to date created hegemonic technology behemoths such as Alphabet, Apple, Facebook, Amazon, Tencent, and Microsoft, who make heavy use of AI to deliver value to many customers. Yet, one can argue that such "corporate" AI utilization falls short of what we might call societal progress (Gümüşay & Reinecke 2021). Our findings indicate that it is when break-through progress

is coupled with the engagement of many stakeholders, avenues for true societal progress of a different nature emerge. In this regard, governments and policy makers have the responsibility and the tools to help companies and entrepreneurial ventures to achieve societal progress.

For example, in the case of entrepreneurial venture 15 (EV15), one path to monetization and scaling is for the Netherlands' government to mandate food-wastage monitoring by restaurants and hotels, which can also help the government to meet its sustainability targets. Indeed, the founder estimated that their AI technology, if installed by 25% of restaurants and hotels, could lead to a reduction of 2% of the government's targeted 50% goal in food waste reduction.

While regulations might provide the constraints necessary for AI for social good to thrive and scale, policy makers can create the impetus for the development of an ecology of small-scale ventures with disruptive AI ideas by providing incentives and scarce resources. For instance, our study found that government laboratories often host budding ventures and that public grants have helped to turn concepts into prototypes that later became full-fledged ventures. This was the case for EV6, which was initiated by researchers who had received government grants to start the project. At EV11, the founder gained impetus by winning a competition organized by Kaggle, a community competition hub for AI and machine learning owned by Alphabet.

Our study finds that Alphabet's influence is pervasive: It serves as a competitor and early adopter of technology, a supplier of computing power, a pro-bono consultant to ventures that apply AI for social good, and a community actor that organizes funding for AI start-ups. As governments in the past have competed by providing tax incentives to large corporations to locate in their territory, it appears that AI for social good will require a similarly targeted approach. Indeed, policy makers need to provide funds to ventures that utilize AI for social good to enable them to attract best-qualified scientists in order to leverage solutions for the grand challenges we face.

**GREATER POLICY INVOLVEMENT IN AI FOR SOCIAL GOOD MAY ALSO HELP TO REDUCE THE TRUST GAP THAT CURTAILS ITS CURRENT DEVELOPMENT**

Greater policy involvement in AI for social good may also help to reduce the trust gap that curtails its current development, while regulation may likely allow democratization of this nascent technology and enable more active participation of small and medium-sized companies. Indeed, our study finds evidence that entrepreneurial ventures welcome greater government involvement. For example, in the case of EV8, the founder appreciated the engagement of policy makers in redefining the boundaries for digital medical care, which then allowed doctors to prescribe digital treatments and also enabled cost coverage by health insurance companies.

# CONCLUSION

Applying AI in a wide range of domains

## CONCLUSION

Our study provides guidance on how to apply AI for social good. Despite AI's increasing relevance and an emerging scholarly interest in its role in society, there is a paucity of research on how AI can be used to benefit society. We identified four main promises and four perils for entrepreneurs who leverage AI for social good as well as listing four takeaways for entrepreneurs and implications for policy makers. The variety of cases reported in this study should encourage entrepreneurs to apply AI to domains and problems that have been featured less prominently in the public discourse than domains such as radiology and recruiting. As scholars and practitioners alike are looking for scalable solutions to address increasingly grave societal issues, it is our hope that this study can shed light on the applicability of AI for positive societal change in ways that can help alleviate grand challenges in a wide range of domains, including equality and inclusion; education, health, and hunger; and climate action.



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# ABOUT

## ALEXANDER VON HUMBOLDT INSTITUTE FOR INTERNET AND SOCIETY

The Alexander von Humboldt Institute for Internet and Society (HIIG) researches the development of the internet from a societal perspective. The aim is to better understand the digitalization of all spheres of life. As the first institute in Germany to focus on internet and society, HIIG has established an understanding that emphasizes the embeddedness of digital innovations in societal processes. Drawing on the scientific competencies brought together at the institute, HIIG is making substantive contributions to our understanding of the relationship between innovation and governance in the digital society. The challenge is to comprehend and change societal values and norms—for example, when developing technologies and business models—but also to do so in an innovation-friendly manner. HIIG was founded in 2011 by the Humboldt-Universität zu Berlin, the Berlin University of the Arts and the WZB Berlin Social Science Center, in alliance with the Leibniz Institute for Media Research | Hans Bredow Institute (HBI) in Hamburg as an integrated co-operation partner.



This study was co-authored by members of the Innovation, Entrepreneurship & Society Group (IES) at HIIG. The aim of the research group is to understand, inform, and co-create innovation and entrepreneurship in a rapidly changing, globally interconnected digital economy and society. The current work of the IES focuses on four research areas, through which we investigate the mechanisms and enablers of digital innovation and entrepreneurship at different analytical levels: Digital Technologies & Value Creation; Collaboration & Openness; Platforms & Ecosystems; Digital Social Innovation & Entrepreneurship.

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