Article

**Studying Impact Tech Startups: A Conceptual Framework, Machine-Learning-Based Methodology, Illustration of Findings, and Research Agenda**

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**Abstract:** The Impact Tech Startup (ITS) is a new, rapidly developing type of organizational structure. As entrepreneurial approaches with technological foundations, ITSs adopt innovative strategies to tackle a variety of social and environmental challenges within a for-profit framework and are usually backed by private investment. The paper firstly provides a conceptual framework for studying this organizational category, as a combination of aspects of social enterprises and startup businesses. It then proposes a machine learning (ML)-based algorithm to identify ITSs within startup databases. The UN’s Sustainable Development Goals (SDGs) are used as a referential framework for characterizing ITSs, with indicators relating to those 17 goals that qualify a startup for inclusion in the impact category. The paper then presents illustrative findings on ITSs derived from interrogation of startup databases relating to Israel and New Zealand and concludes by proposing a research agenda for studying the ITS as a distinct organizational category.

**Keywords:** keyword 1; keyword 2; keyword 3 (List three to ten pertinent keywords specific to the article yet reasonably common within the subject discipline.)

1. Introduction

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**2. Background: The Calls to Transform the Economy**

The evolution of ITSs since around 2010 has come about against a background of a growing international awareness that the world’s future will be bleak if it continues to pursue profit maximizing, neo-liberal economic policies without regard to the effect on health, social conditions, and the environment. In recent times, calls for change have come from institutions once staunch supporters of neo-liberalism, such as the International Monetary Fund (IMF) and the World Economic Forum (WEF) (Malaert and Schwab, 2020), as well as the financial leading financial media outlets (Financial Times, 2019). These calls have been echoed by large companies such as Walmart, which has set itself the goal of become a “regenerative company” that produces zero net emissions by 2040. It also aims to protect, manage or restore at least 50 million acres of land and one million square miles of ocean by 2030 (Walmart, 2020). The COVID-19 crisis has intensified the criticism on the prevailing economic system: as Nobel Prize Laureate entrepreneur, economist, and civil society leader Muhammad Yunus has stated: “Don’t plan for economic ‘recovery’ post Covid. Redesign it from scratch.” (Yunus, 2020). British entrepreneur and social commentator Ronald Cohen has proposed methods for constructing forms of corporate accounting that evaluate the positive or negative impact companies have in relation to social and environmental issues (2020a). In a recent interview, he suggested that “by measuring and valuing impact, we can bring the invisible heart of markets to guide Adam Smith’s invisible hand” (Cohen, 2020b). Such ideas require businesses to change, to some degree, from strictly profit-oriented goals of increasing value for shareholders, into entities that have additional objectives in the areas of society and the environment.

The concept of hybrid organizational structures that combine commercial, social, and environmental objectives gained traction after the 2008-2009 economic crisis, especially after the 2011 “Occupy Wall Street”-style protests that took place in hundreds of cities around the world. After the demonstrations subsided, a phase of creative thinking on the topic became evident in hundreds of forums in which policy makers, professionals, activists, and entrepreneurs discussed how to give concrete expression to a new desired reality in which business organizations could also promote social and environmental objectives. This gave rise to a variety of organizational frameworks that can be subsumed under the title of social enterprises (Gidron & Domaradzka, 2021). This overlapped with the “dot.com revolution” that gave rise to startup industries. Tremendous advances in Information and Communication Technology (ICT) furthermore provided a platform for entrepreneurs to build innovative, even revolutionary products that quick drew the attention of private and public investors. This led to the combining of venture capital with such startups.

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2. They aim for scalable, repeatable, and proﬁtable business models (Blank, 2018).
3. They create innovative goods and services and/or develop processes under conditions of extreme uncertainty, with little or no operating history and experiencing high volatility in technologies and markets(Giardino et al., 2014; Cho and McLean, 2009; Krejci et al. 2015).
4. They aim to provide solutions to hitherto largely unsolved problems, while exploring new business opportunities; Startups have also been frequently associated with a certain mindset and/or a different way of thinking (Robehmed, 2013).

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 **Figure 1:** Conceptual and Organizational Roots of ITSs

 of Figure 1

**4. Methodology for Studying ITSs**

*4.1. Overview*

In the early twentieth century, the study of new organizational categories started by observation and then conceptualization. Max Weber’s study of bureaucracy is a prime example. Later in that century and into our own, conceptualization and theorizing of a new organizational phenomena starts by mapping them. A case in point is the study of the non-profit or “third sector” in the 1990s, which began with comparative mapping of over 40 countries. That study was enabled by the adoption of a common definition of the nonprofit organizational form which later became the standard one adopted by the UN (UN, 2003). The results of that mapping phase, which provided detailed data on the economic, legal, historical and policy dimensions of the nonprofit sector, were the cornerstones of the conceptual literature that ensued, notably for the development of social origins theory that categorized countries by their nonprofit regimes (Salamon & Anheier, 1998). While this theory was later criticized (Anheier, Lang & Toepler, 2020), it was a mid-range theory that prompted broader conceptual development of the field, including a division of organizations in society into three sectors, as opposed to the previously prevalent two-sector concept of a society (that is, public and business). These breakthroughs brought about a multi-disciplinary research agenda for the nonprofit sector and civil society that enriched knowledge in this and related fields.

According to Leavit et al. (2021), a study of a new organizational form must start with a description of its main features and characteristics before comparing it with similar organizational forms. ML methodologies that identify organizational categories are a first step, either complementing or superseding earlier survey methodologies. Leavit et al. suggest that “ML may serve especially useful for testing boundary conditions, moderators, and inflection points, as the processing power of ML can allow for the testing of complex combinations of predictors which may otherwise go overlooked” (p. 20).

Such a methodology allows us to present detailed descriptive data on our case to hypothesize about relationships to a range of contextual variables, providing an infrastructure for theory building. In the process of categorizing ITSs as unique, a process of mapping that phenomenon is an obvious first step. This will enable us to focus on their structural attributes, which may distinguish them both from social enterprises and regular startups. Such mapping is crucial for both conceptualizing the phenomenon and developing a research agenda.

Given the interest in and government encouragement in many countries of the startup phenomenon as an important component of the economy, databases on startups exist at a regional, national, and international levels. Thus, a first step in mapping ITSs is to identify them from those databases.

Distinguishing ITSs in these databases from social enterprises presents a major problem in that there is a lack of agreement on definitions of them. Defourny & Nyssens (2020), a major international study of the social enterprise phenomenon, was nonetheless unable to compile a database of such entities and had to settle for simple identifying social enterprise models. The models identified are based on the different legal statuses of social enterprises (the social-business model, the social-cooperative model and the entrepreneurial nonprofit model), not on their use of technology or other characteristics.

Distinguishing ITSs from social enterprise databases remains a worthy task, where databases make it possible. Doing so will complete the partial picture obtained from analysis of ITSs within startup databases.

*4.2. Identifying ITSs Within Startup Databases: The UN SDGs as a Reference Framework*

One of the challenges of studying impact has been the lack of agreement and shared language on what constitutes positive social and environmental impact (Choi & Majumdar, 2014; Perrini, Costanzo & Karatas-Ozkan, 2020; Molecke & Pinkse, 2017). In recent years, an important unifying factor in defining the parameters of impact have become the UN SDGs (UN SDG, 2017). This framework, issued in 2015, sets out 17 interlinked goals for a better and more sustainable future, along with 169 indicators. These SDGs are considered the most ambitious effort to place such goal setting at the center of global policy and governance (Biermann, Kanie & Kim, 2017). Concomitantly, SDGs have been identified as highly beneficial for both business and investors as they set out the best long-term strategic market outlook for global policy making (Pederson, 2018; Surana, Singh, & Sagar, 2020). More specifically, SDGs are a valuable reference point for impact investors (Schramade, 2017; Reisman & Olazabal, 2016).

The process of distinguishing ITSs in startup databases involves the use of Artificial Intelligence (AI). Although algorithms used for such tasks have been based on keyword identification, the methodology we have proposed is based on natural language processing (NLP) technology providing a deeper analysis of the brief description appearing in the “About Us” section of a startup’s website. The algorithm is designed to classify the startup by labels according with the 17 SDG goals. To accomplish that, we have taken a data-driven approach by refining an ML model for descriptions of startups that were previously labeled for SDGs by Rainmaking (https://rainmaking.io/), a major platform in this field. To address the semantic variability of the descriptions, as well as to compensate for the relatively small number of labeled examples that are available for training the algorithm, we have used BERT. This is one of the most popular emerging neural-network-based NLP technologies based on a massive database of free English texts taken from a number of sources, and it learns the distribution of words in their context, an approach also known as transfer learning(Devlin, Chang, Lee & Toutanova, 2018). Using this algorithm, we have been able to predict a single SDG label for a given startup. We experimented with two sets of labels. One included all 17 SDG labels, and another that clustered the 17 SDGs together under five labels: People, Planet, Prosperity, Peace, and Partnerships. To evaluate the performance of the algorithm, we excluded about 10% of the startups from the training collection and calculated the accuracy of the algorithm’s predictions. In our best scenario, we were able to achieve a 77% accuracy for predicting one of the 17 SDGs, and 82% for predicting one of the 5 categories. Analyzing the mistakes established that most happened in relation to SDGs for which we had a relatively small number of relevant labeled startups. By removing 10 of those SDGs from the task and retaining only the most prominent goals, we were able to improve the results to 83% and 89% respectively and, in an ML process, train the computer to identify those that possess the qualities sought. A paper focusing on the methodology for the algorithm’s development is in the process of being written.

That process allowed us to distinguish ITSs from other startups and to categorize ITSs by the 17 SDG categories. The process also has the potential to provide insight into those startups that have the potential to address the SDGs, namely those that operate in relevant fields but have not yet adopted a framework for addressing social and environmental issues.

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1. The organizational and inter-organizational dynamics of the ITS: How the social and environmental objectives, as opposed to the commercial ones, find expression in the ITS’s daily operations; what the governance structure is; how decisions are made; how impact is measured; what the ITS’s inter-organizational connections are.

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**Data Availability Statement:** In this section, please provide details regarding where data supporting reported results can be found, including links to publicly archived datasets analyzed or generated during the study. Please refer to suggested Data Availability Statements in section “MDPI Research Data Policies” at https://www.mdpi.com/ethics. You might choose to exclude this statement if the study did not report any data.

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