

# IARIW-ESCoE Conference

## “Measuring Intangible Assets and Their Contribution to Growth”

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### Intangible Capital Indicators Based on Web Scraping of Social Media

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Knowledge-based capital is a key factor for productivity growth. Over the past 15 years, it has been increasingly recognised that knowledge-based capital comprises much more than technological knowledge and that these other knowledge components are essential for understanding productivity developments and competitiveness of both firms and economic aggregates (sectors, regions, and economies). In the tradition of the new growth theory (Romer, 1986, 1990; Lucas, 1988) knowledge-based capital, also denoted as intangible capital, is often measured by the stock of technological knowledge and is approximated by accumulated R&D expenditure or the stock of patents.

Corrado et al. (2005, 2009) have proposed a classification of intangible capital goods that comprises three main components: (1) innovative property, (2) computerised information, and (3) economic competencies. While the first two components are already covered by different statistical surveys (R&D survey on technical knowledge, innovation survey on technical and non-technical innovation-related knowledge, investment surveys on expenditure on computerised information such as software and databases), comprehensive statistical data on economic competencies are scarce. These competencies include in particular firm-specific human capital, organisational capital, as well as brand equity.

In this paper, we describe a new way of measuring investments in economic competencies that do not require firm surveys but are calculated on the basis of publicly available data from online platforms. We focus on two types of economic competencies: investments in brand equity and investments in firm-specific human capital. For brand equity, we use the number of “likes” of a company on Facebook as our indicator. Individual ratings (by employees) on the employer branding and review platform Kununu provide information for both the “company image” (brand equity) and on-the-job training/career development (firm-specific human capital). Both platforms are market leaders in their respective segment in Germany. Compared to survey-based data, publicly available platform data provide a much broader coverage at substantially lower costs, a much higher timeliness, and a much higher frequency.

However, the quality of platform data might be contested. In order to provide a first test of data validity, we compare the two newly developed indicators with survey-based expenditures on

marketing (brand equity) and on-the-job training (firm-specific human capital), using data from the Mannheim Innovation Panel (MIP), which is the German part of the Community Innovation Survey of the European Commission. The results show a positive and significant relationship between firm-level expenditures for marketing and on-the-job training and the respective information stemming from the online platforms Facebook and Kununu. We therefore explore the possibility of predicting brand equity and firm-specific human capital with machine learning methods.

In this paper, we contribute to the literature in two ways. First, we describe a fairly generalizable method for matching and linking firm-level survey data and platform-based data. Second, using publicly available information from social media, we are able to derive new indicators of firm-specific human capital and brand equity that can complement firm surveys, thus improving the measurement of knowledge-based capital.

When we compare these platform-based intangible capital indicators by means of OLS regressions with firm-level survey data on marketing and training expenditure taken from the German part of the Community Innovation Survey, all regressions show a positive and significant relationship between the firm-level expenditures for marketing and on-the-job training and the respective information stemming from the online platforms. Various robustness checks confirm the validity of the results.

However, there are also caveats with our current approach. Due to the limited presence of smaller firms on online platforms, we are currently predominantly capturing medium-sized and larger firms. Furthermore, although we do find a positive and significant relationship between our platform-based indicators and the survey-based numbers in our OLS regressions, predicting expenditures based on an explorative machine learning approach shows that the platform data alone have little or no predictive power. MIP data explains a higher amount of the data and outperforms the platform data. Combining platform data (Facebook or Kununu) with MIP data (turnover, number of employees, industries) has at most a slight effect or no effect on the results.

Using data from online platforms can nevertheless provide a useful source for establishing firm-level indicators on intangible assets in the field of economic competencies, which are difficult to measure through surveys or from balance sheet data. But in order to better utilise this data source, further research is required in the future. First, we need a better understanding of the dynamic relationship between activities on online platforms related to a firm's knowledge-based capital, and the actual firm activities to build up and maintain such capital. Secondly, comparative analysis of different platform data are needed to better assess the value of the information that can be derived from various platforms. Finally, analyses on the relationship between the newly derived indicators on firms' economic competencies on the one hand and firm performance on the other (e.g., through productivity analysis) would provide additional insight into the validity of these indicators. For this purpose, time-series data on both platform-based indicators and firm performance measures would be required.