

Digital Media Metrics for Valuing Knowledge Assets

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Abstract: A growing literature is exploring the potential of using new sources of data to estimate knowledge asset levels and intellectual capital. In particular, digital media and related metrics (such as sentiment analysis), thought to be related to brand equity, show potential for assessing the intangible assets of the organization, particularly relational capital. Previous presentations at the European Conference on Knowledge Management have explored this topic in different industries and with different metrics. On the digital media side, metrics such as volume, engagement, impact, and sentiment are readily available as well as more in-depth details such as preferred platforms. Studies have suggested that high levels of digital media activity are strongly associated with brand equity, a marketing concept that can reasonably proxy relational capital. More recent work has expanded this relationship, specifically looking at whether the digital metrics can capture all of intellectual capital or knowledge asset value—to the extent that digital chatter reflects brand quality as well as the customer's brand perception, one can make the case that human/structural capital delivering superior customer experiences is also a part of digital-oriented values. So last year's ECKM paper included not just brand equity as the outcome predicted by sentiment analysis but also price/book value, a recognized proxy for overall intellectual capital drawn from financial statements. This study draws on that foundation to further explore the digital media metrics and price/book relationship. Price/book can be calculated for any listed public company, greatly expanding the range of firms that can be studied. Price/book can also be adjusted as stock price changes, so rather than a single annual value like brand equity, price/book can be recalculated on a monthly or weekly basis and directly compared to weekly sentiment analysis results. The paper will report on an initial investigation of correlation results from digital media metrics related to brands and price/book ratios recalculated on a weekly basis from a range of B2B technology companies. These can be compared to findings from using the previous brand equity methodology. Deeper analysis is possible from the results, including firm-by-firm calculations or variable manipulation (e.g. lagging) and can be extended from this preliminary work.

Keywords: Intellectual capital, Knowledge assets, Price/book ratio, Brand equity, Sentiment analysis, Neural networks

1. Background/Literature Review

A continuing question in intellectual capital (IC) and knowledge management (KM) research is the impact of IC/KM strategies on firm performance. In one sense, the topic is addressed all the time as self-report surveys collect data on KM practices and procedures as well as respondent perceptions of organizational success. Other studies have employed more objective metrics based on financial statement results, providing a different type of analysis with interesting insights but still not without issues.

Recent studies have renewed the question about whether IC/KM has really established the impact of better management of intangible assets leading to superior firm performance (Erickson & Rothberg 2025a). The topic had considerable attention in the late 1990s and early 2000s as the fields looked to establish themselves and has developed apace but still begs important questions about correlation and causality. Given spotty results on whether a correlation exists and methodological questions, whether and how KM actually influences organizational performance remain open questions.

On the one hand, survey approaches have dominated the discussion of the last twenty years, proving particularly useful in isolating particular independent variables such as knowledge management practices (KMPs) or similar more precise approaches that identify key activities or circumstances and try to assess their impact on performance (Durst, Edvardsson & Foli 2023, Durst & Edvardsson 2012, Andreeva & Kianto 2012, Alavi & Leidner 2001). While empirically compelling and providing important contributions, such approaches are survey-based. As a consequence, they rely on subjective, self-report data and often stray into full-firm performance outcomes the ground-level knowledge workers may not be fully qualified to assess (financial performance, innovation performance, etc.). This is especially true given the non-random, non-representative samples used in many such studies (undergraduate students, employees in a single firm, knowledge workers in a specific geographic area). Survey approaches have their attractive aspects and interesting results but also demonstrate clear limitations in the extendibility of the work.

On the other hand, part of the research into IC/KM, particularly into IC, has always focused on demonstrating the financial impact of investments in better managing knowledge assets. Financial statements provide recognizable outcomes such as profitability, return on investment/equity/assets, and similar objective results. A number of metrics developed for measuring IC or intangible assets in general also grew out of applying financial results, usually some combination of firm value and asset holdings, showing the value-enhancing

efficiency of the assets as a proxy for success (Sveiby 2010). Well-known approaches such as Tobin's *q* (Tobin & Brainerd 1977) and Pulic's VAIC (2000) both employ this type of metric and have been widely used (Soewarno & Tjahjadi 2020). Although also a valuable tool for assessing the impact of IC/KM on the organization, especially given its more objective data, this type of approach has its own issues. In particular, studies often run a comparison between the impact/value of IC or intangible assets as an independent variable vs. financial performance as a dependent. Such a construction will often have a confounding variable problem as similar components, by definition, are present in both variables—most obviously profitability which is directly or indirectly in the outcomes measures and also figures into the firm's perceived value (typically market capitalization, the market's assessment of value as seen in the stock price), part of the independent variable.

In short, although considerable important work has been done on whether effective KM improves organizational performance, as well as how it does so, the discipline's approaches have flaws that have often left researchers short of a definitive conclusion. One key would be to identify objective, unrelated metrics on both sides of a correlation calculation. If both measures come from the same self-report survey or the same values are obtained, by definition, from related results in financial statements, discovering a relationship is a less significant finding than might be the case if unrelated metrics could be employed.

This approach has been explored in some research. Andreeva & Kianto (2012), for example, conducted survey research but supplemented the performance results obtained from the questionnaire with independent data drawn from financial statements. If more options can be developed for use in assessing the impact of knowledge management, results from the field may have more impact, allowing more influence on decision-makers and their attitudes toward KM.

1.1 Digital Marketing Metrics

Previous work, much of it specifically for this conference, has explored using readily available digital and other metrics often associated with marketing (Erickson & Rothberg 2025b, Erickson & Rothberg 2024, 2023, Erickson 2023). They have the advantage of being independent of any survey used as a source for related data on KM attitudes and practices and/or data on organizational performance from financial statements. And a strong case can be made that digital media metrics are related to knowledge assets, specifically the intellectual capital component of relational capital (Bontis 1999, Edvinsson & Malone 1997).

Relational capital, sometimes considered customer capital early in its development, is defined as the value of knowledge about dealing with entities outside the firm. To the degree that much of that value is found in customer knowledge, one understands the original terminology of customer capital—but researchers later extended the concept to relational capital, covering other potentially valuable relationships such as with suppliers, vendors, research partners, etc. But customer relationships do often dominate, particularly when looking at consumer goods. If so, marketing metrics come into play as a means to assess the concept. Particularly brand equity as one definition suggests the dollar value comes from the accumulation of positive interactions between the brand and customers (Seggie, et al. 2006, Ailawadi, et al. 2003, Keller 1993, Aaker 1996, 1991). Those repeated interactions lead to the brand better understanding the customer, or, in the parlance of intellectual capital, an increased store of knowledge about what the customer and what they want.

Relational capital, then, is an understudied and under-measured concept. And, as we'll discuss, one can certainly make the claim that customer knowledge in an age of big data and relationship marketing is a burgeoning and increasingly important intangible asset in organizations. Relational capital builds through repeated successful interactions between the seller and the customer. The seller accumulates data, often on individually identifiable buyers, and learns what satisfies that customer (Sussan 2012, Stahle & Stahle 2012). In other contexts, this value is often referred to as brand equity. Turning the vast pool of customer data into actions delivering loyalty demonstrates deep brand equity and relational capital (Chang & Tseng 2005, de Castro, et al. 2004). So what can we take from the available data and related marketing concepts to change our thinking on how we might measure relational capital or even full intellectual capital in organizations?

From this basis, we can go back to how digital media metrics might be related. More recently, brand value is associated not just with product use experiences but also digital interactions surrounding the brand. Information and communication technologies enhance interactions and have expanded individualized, identifiable contact between buyer and seller (Lechman 2017). The result is a wealth of data concerning users that can be used to build knowledge, not only on an aggregate but on a personalized level (Rothberg & Erickson 2017, Sigala & Chaikiti 2014, Levy 2009). The personal level results can then be re-aggregated to establish an overall public perception of the brand and, by extension, its value or brand equity.

Brand equity, at least for top, high-value brands, is commonly reported by marketing consulting agencies and others with proprietary methodologies (Interbrand 2026). These estimates would likely involve some combination of financial results (sales), operating results, and customer sentiment. Attempts to use them to assess relational capital widely, however, are limited by the number of reported results such as “top 100 brands” and by the metric’s opaqueness. But the concept of brand equity and a likely relationship to relational capital is theoretically solid and suitable to explore further.

In fact, beyond the positive financial or market outcomes that we know come with valuable brands, we can go back into the basics of the brand equity definition: successful interactions between the organization and users/customers over time. In today’s world, one important aspect of these interactions is readily available, digital activity surrounding a brand. As users or customers are pleased, disappointed, or simply showing interest in a brand, they will react on social media and other digital media outlets (Rovai 2002). Not only are quantitative metrics of interest for judging a brand’s standing with the public, but digital postings can also provide helpful depth, often delving into the reasons behind the feelings (Rizun & Kucharska 2018). Consequently, both scholarly (Selimovica 2024, Fagundes, et al. 2023) and practice researchers (McDowell, et al. 2023) are exploring how digital media data might be related to the value of brands, bringing attention to a largely unexplored research area (Algharabat, et al. 2020).

This paper further explores how sentiment analysis and other digital media metrics are correlated with not just relational capital but overall intellectual capital. Previous work has established that digital measures such as volume, variability, and engagement are connected with brand equity in several industries (Erickson & Rothberg 2024, Erickson 2023, Erickson & Rothberg 2023, Erickson, Schmidt & Rothberg 2020). And last year at ECKM, the analysis was extended to the relationship between the digital data and intellectual capital itself, applying the price/book ratio reported in financial results (Erickson & Rothberg 2025b).

Importantly, this approach shows potential in getting around some of the previous difficulties in assessing the relationship between intellectual capital/knowledge assets and organizational performance. All of the data are gathered from objective (and often voluminous) data sources and so avoid the subjectivity of survey approaches to the topic. On the other hand, although it uses accepted financial metrics on one side of the correlation assessment, on the other are entirely independent digital media metrics. Consequently, the confounding variable problem seen in many of the more financial-oriented approaches is not an issue. As a final extension, then, if digital media data can usefully be applied as an indicator of intellectual capital/knowledge assets, then it can be evaluated as a predictor variable in assessing its relationship with financial performance. IC could be run against performance outcomes in a definitionally different, objective manner. The results could be more convincing in establishing the relationship between IC and performance.

2. Methodology

As noted, previous work gathered digital media metrics in specific industries, allowing direct comparisons of firms with similar businesses and eliminating any biasing effects from differences in how intangible assets are applied across industries. Such data can be collected by sentiment analysis programs. In this case, Sprout Social’s listening capabilities were used to collect data by scraping the entire web for mentions of chosen brands, specifically nine B2B technology companies listed in the Interbrand Top 100 most valuable brands (Adobe, Cisco, IBM, Intel, Microsoft, Nvidia, Oracle, Salesforce, SAP).

Extending the briefer reporting periods applied in previous research, digital metric data were collected for each brand for a one-week period at the beginning of each month across a full year (April 2025 through March 2026), totaling 12 observations per brand. Data included:

- Volume (number of posts mentioning brand, thousands)
- Share of voice (% of volume)
- Impressions (views of posts mentioning brand, millions)
- Engagement (responses to posts mentioning brand, thousands)
- Sentiment (% positive)

In addition, financial data were collected for each brand/firm. The 2025 year-end price/book ratio was taken from annual financial statements. As noted earlier, the well-established Tobin’s q is an often-used metric (in some form) for intellectual capital, and price/book is an easily collected variation. But to further capture the dynamic relationship between periodic digital media data and the price/book proxy for intellectual capital/knowledge asset holdings, stock price data were also collected corresponding to each reporting period.

While physical assets change slowly over time, so the once-a-year reporting of book value is suitable for part of the outcome metric, the market value does vary daily with stock price. Consequently, stock price was collected to match up with the digital metrics collection periods, and a price/book ratio calculated matching those dates. This approach builds a dataset with weekly/week-ending independent and dependent variables, on its face a more accurate representation of user activity sentiment toward a brand and its intellectual capital at specific times.

Previous studies with digital metrics used brand equity as the dependent variable. As noted earlier, a case can be made that brand equity and the relational capital component of intellectual capital are conceptually similar constructs. Using price/book, in theory a measure of all of IC rather than just relational capital, the discussion is changed a bit. But one can also argue that relational capital is growing into an ever bigger component of intellectual capital in today's world as much of an organization's knowledge is geared toward positive customer relationships, whether through market-oriented innovation, consistent customer experiences with products, or interactive customer communication. As such, a metric for relational capital may be a decent proxy for all of intellectual capital or even a competent direct measure. This study will test that idea.

More directly, the analysis will focus on the correlation between collected digital media variables and IC as measured by price/book ratio for nine selected B2B technology brands over time. A year of data, gathered on a one-week-per-month basis is applied, with 108 observations available. If digital media metrics can be convincingly linked to IC, then they can also be used in place of IC to assess its relationship to organizational performance.

SAS Viya was used for the statistical analysis, allowing not only easy manipulation of variables and substantial, detailed results but also a variety of models. In this case, linear regression and a neural network were both applied to the data, with direct comparison of outcomes. Additional analysis techniques could be used and evaluated in future research, as could variations on the data such as lagging the outcome results to review how quickly digital media users' sentiment is reflected in performance outcomes.

3. Results and Discussion

One beginning step was to judge the correlation between the independent variables. It seems fairly obvious that more volume in digital media posts would very likely be related to more impressions and both would be related to more engagement. The relationships aren't absolute, of course, but whatever percentage of volume that elicits substantial impressions and engagement, that would result in increased numbers in the follow-on variables. If so, of course, substantial multicollinearity is likely in the data. Not a fatal flaw in the analysis but certainly a fact to take into account.

Consequently, a correlation matrix was constructed including the available independent variables and the dependent price/book variable. The results are included in Table 1.

Table 1: Correlation Matrix

	Volume	Share	Impressions	Engagement	Sentiment	Price/book
Volume						
Share	.889					
Impressions	.914	.832				
Engagement	.895	.798	.853			
Sentiment	-.483	-.443	-.449	-.483		
Price/book	.051	.079	.136	.240	.394	

As expected, a number of the correlations are quite high, especially between volume, share, impressions, and engagement. They are not absolute but clearly have close relationships that will lead to noticeable collinearity in a regression analysis. As also noted, collinearity is not a failure in such an analysis but it does require care in assessing the results. The negative relationship of sentiment with all the other variables is surprising but also potentially interesting and can be noted for later exploration.

With that in mind, the linear regression results are included in Table 2. The independent variables include all those previously mentioned: digital media volume, share of voice, impressions, engagement, and sentiment. Price/book ratio was the dependent variable.

As seen in the table, the overall relationship is robust, especially for a fairly small dataset ($n=108$). The R^2 is .4291, so the variables explain over 40% of unexplained variance in price/book ratio. Average squared error (ASE) is also included to allow comparison to the neural network results. As a guideline, the dataset price/book ratios run between 0.89 and 28.29, so an ASE of 31 suggests an average prediction error of 5-6. A relationship is there and relatively strong but still shows considerable error in predicting price/book values (or intellectual capital, for our purposes).

The individual components show significance in the intercept, engagement and sentiment. Given the substantial multicollinearity apparent, we can take the overall quality of the overall quality results with some confidence but should view the individual variable results with some skepticism. Engagement and sentiment are both significant at the 99.9% level with very high corresponding p-values, but those values can't be fully relied upon. The main conclusion that can be drawn is that the overall equation has some predictive power and some combination of the colinear variables is responsible.

Table 2: Correlation Analysis Results

	Linear Regression		Neural Network
	$R^2 = .4291$, ASE = 31		ASE = 4.7
Parameter	Coefficient	P-Value	Relative Importance
Intercept	-8.78	.005	
Volume	-0.028	.092	0.887
Share	-0.023	.839	1.000
Impressions	0.00002	.584	0.454
Engagement	0.008	<.0001	0.633
Sentiment	0.254	<.0001	0.658

But circumstances such as these can also be assessed with neural network analysis. The logic of the process is that same as that with linear regression, as the selected independent variables are evaluated for their correlation with the dependent variable. So we can run the same analysis using a neural network.

The key aspect of neural networks is that they can create a second tier of variables (neurons) based on relationships between the initial variables, weighting contributions based on these relationships. In a way, the collinearity is a positive feature of the process as the created neurons take advantage of the differing relationships as the influence of each variable on each neuron is determined through iterative trial and error. While the structure of the final model and its details is too complex for the system to report, we receive enough information in the results to judge the quality of the fit. As with the linear regression, the strength of the overall equation can be assessed and relied upon even though specifics concerning the variables or neurons are less available.

But we do have some details. Neural networks do not generate R^2 statistics but do provide an ASE, as included in the linear regression results. The neural network results drop the ASE to 4.7, and the more detailed data show an average predicted price/book of 26.82 and an actual figure of 26.76 (a few outliers likely inflated the ASE calculation). The ability to take the full data set and weight/tailor it to prediction leads to remarkable accuracy in identifying the price/book outcome.

As before, the individual variables are harder to evaluate. We do have some results concerning their relative importance in the final solution (what they contribute to each neuron in achieving the overall result, in a sense) and share of voice comes out the most influential with the volume variable close behind. But all of the variables make some contribution. Impressions is the lowest at .454 and so, again, it is the mix of variables, their recombination, and the iterative process in applying them that provides the high level of accuracy in the outcome, not the influence of any single explanatory variable. One thing we do not know is the sign of each variable's contribution, so whether positive or negative is indeterminate.

The SAS Viya visual comparison of the models is included in Figure 1.

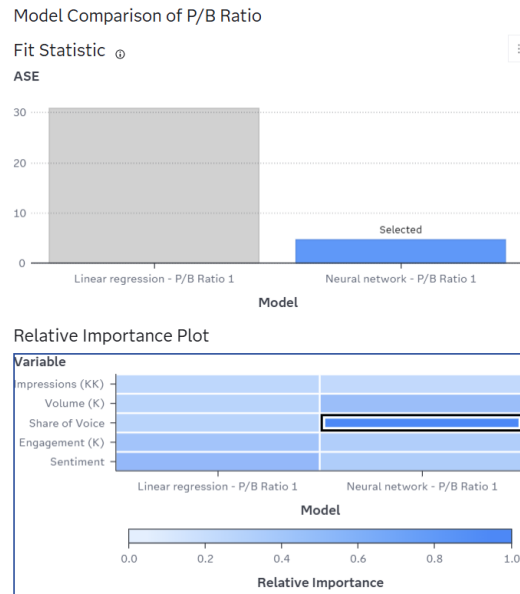


Figure 1: Model Comparison

The results validate the initial insight that digital media metrics can be a useful indicator of the intellectual capital or knowledge asset holdings of organizations. Although limitations exist in identifying which specific variables are individually important in the prediction, using advanced techniques such as neural networks strongly suggest that these variables, used as a group, are effective and accurate. En masse, they are a reliable indicator.

4. Conclusions

This study, of course, is preliminary, limited to B2B tech firms, and using a relatively small sample. As such, it should be taken as exploratory research only. But there is enough of a positive outcome here to recommend further confirmatory research with a larger sample and ranging across more business sectors. The methodology works and applying it to larger and more diverse samples would further demonstrate its effectiveness as well as any yet unseen issues or weaknesses.

Digital media metrics could become an easily available, reliable assessment of IC, encouraging wider use in academic studies and in practice. The digital media results, collected routinely as sentiment analysis, can be easily compiled and applied. As such they can be accessed to study intellectual capital in academic studies, better understanding the details of which firms have more or less IC and leading to more answers on how and why they reached those levels. In practice, the same metrics can be used by managers to understand the knowledge assets at their disposal, how they compare to competitors, and some initial guidance as to what to do about expanding or closing the gaps.

Further, with an objective, independent measure of IC, the continuing question of whether better management of knowledge assets leads to better organizational performance can be more persuasively answered. As noted earlier, attempts to tie the KM/IC field to better business outcomes often relies on subjective self-report surveys or financial statement results that use similar, confounding variables as both predictor and result. While those of us working in the field believe in the benefits of KM to practitioners, the link is still being supported as definitive studies are hard to come by. With a new metric for IC, better, more convincing work can be done with this IC measure clearly objective and independent of outcome variables based on financial results. Variations on the correlation analysis, such as simple regression (to clarify issues such as the sign of the sentiment variable's impact) and lagged outcome variables can be easily explored as well.

AI and Ethics Declaration: The research involved no human subjects but only aggregate data collected from publicly available social media platforms. AI programs were used to obtain (and validate) some of the financial statement data. No AI tools were used in any way in the paper's development or writing.

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