Intellectual Capital Measures: Literature Review

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Abstract--**In era of knowledge-based economy, enterprises are in the new game to win by Intellectual Capital which is the key of corporate competitiveness. Hence, measurement of Intellectual Capital becomes an urgent task for organizations. Sveiby (2001) divided the measuring methods into four categories, namely DIC (Direct Intellectual Capital Methods), MCM (Market Capitalization Methods), ROA (Return on Assets Methods) and SC (Scorecard Methods). This study adopted this classification method to review the total 466 articles published in *Journal of Intellectual Capital* from the initial issue in 2000 to 2013, and classifies the 45 articles concerning intellectual capital measures. The purpose is to gain an insight into the development and application of various measuring methods for the reference of future research and practical application.**

I. INTRODUCTION

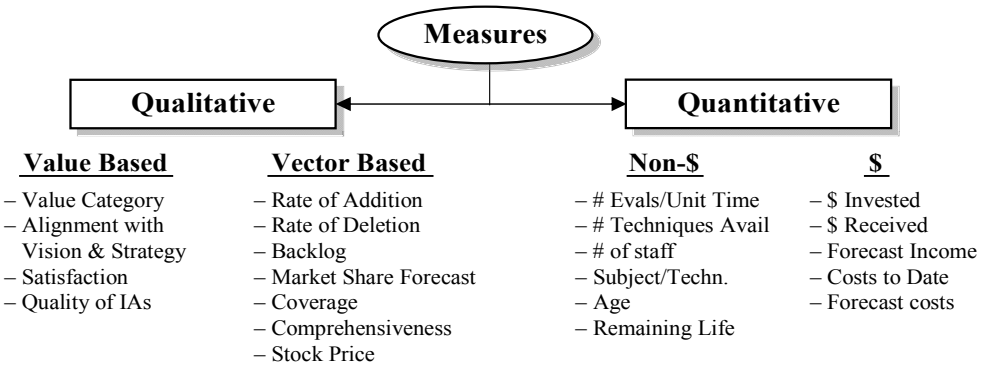
In the 1980s, Sveiby, a Swedish knowledge management guru, pointed out that traditional accounting methods could not present a complete picture of the value and competitiveness of the enterprises, and indicated the importance of intangible assets. [47] In 1991, Stewart, the editor-in-chief of *Fortune*, mentioned that "Intellectual capital is becoming corporate America's most valuable asset and can be its sharpest competitive weapon".[42] This was the first time the term "Intellectual Capital" appeared in literature. In order to overcome the weakness of traditional accounting in insufficiency of reporting the real value of the enterprises, the methods of measuring Intellectual Capital (IC), as well as the reporting methods of IC were developed. In 1987, Japanese scholar Hiroyuki Itami compiled a book entitled *Mobilizing Invisible Assets*, in which the conception of intangible asset computation is proposed. [19] In 1991, the Skandia group in the Northern Europe assigned Professor Leif Edvinsson, a Swedish IC master, to be the first global IC director, and released the first public intellectual capital annual report in May 1995, as a supplement to their financial report. This report listed 111 major indexes, 18 financial focus indexes, 20 customer focus indexes, 19 process focus indexes, 32 renew and development focus indexes, and 22 human focus indexes. [14] In 1997, Stewart proposed IC Star Map which can show corporate performance from several points of view. [43] In 1998, the IC measuring system was proposed by Lynn. [30] In 2000, Sullivan proposed the measuring method between the quality and quantity of IC. [46]

The measuring methods of IC vary from the research orientation and background. Sveiby [48] summarized the measuring methods into four categories, namely DIC(Direct Intellectual Capital Methods), MCM(Market Capitalization Methods), ROA (Return on Assets Methods) and SC (Scorecard Methods). This study adopted this classification method to review the papers published in *Journal of Intellectual Capital* from the initial issue in 2000 to 2013, and classified the literature concerning IC measures. The purpose is to gain an insight into the development and application of all kinds of measure methods for the reference of future studies and practical application.

II. CLASSIFICATION OF MEASURING METHODS

A. Quality and Quantity

Sullivan [46] proposed the classification methods between the qualitative and quantitative of IC (Fig. 1), in which the measure of qualitative falls into two categories, namely value based and vector based. The measure of quantitative is classified into $-based and non-$ based.



Source: Sullivan (2000)

Fig. 1：Example measures for intellectual capital

B. DIC, MCM, ROA and SC

Sveiby [48] referred to Luthy (1998) and Williams (2000), and proposed the classification methods of DIC, MCM, ROA and SC.

(1) Direct Intellectual Capital methods (DIC) [48]
Estimate the $-value of intangible assets by identifying its various components. Once these components are identified, they can be directly evaluated, either individually or as an aggregated coefficient.

(2) Market Capitalization Methods (MCM) [48]
Calculate the difference between a company's market capitalization and its stockholders' equity as the value of its intellectual capital or intangible assets.

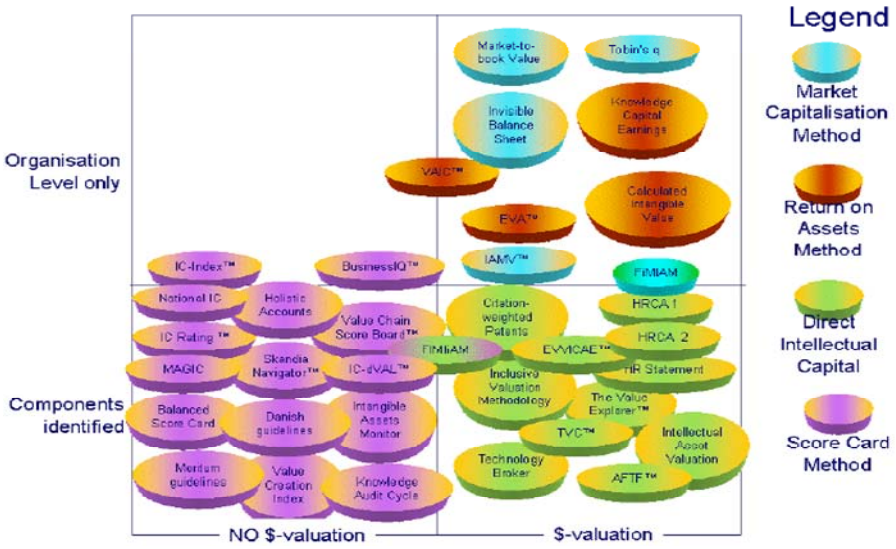
(3) Return on Assets (ROA) [48]
Average pre-tax earnings of a company for a period of time are divided by the average tangible assets of the company. The result is a company ROA that is then compared with its industry average. The difference is multiplied by the company's average tangible assets to calculate an average annual earning from the Intangibles. Dividing the above-average earnings by the company's average cost of capital or an interest rate, one can derive an estimate of the value of its intangible assets or intellectual capital.

(4) Scorecard Methods (SC) [48]
The various components of intangible assets or intellectual capital are identified and indicators and indices are generated and reported in scorecards or as graphs. SC methods are similar to DIC methods, expect that no estimate is made of the $-value of the intangible assets. A composite index may or may not be produced.

C. Sveiby [48] summarized the 42 methods for measuring intellectual capital into the four categories, as is shown in Table 1:

TABLE 1: 42 METHODS FOR MEASURING INTANGIBLES

Approx. year	Label	Major Proponent	Category
1950's	Tobin's Q	Tobin (1997)	MCM
1970's	Human Resource Costing & Accounting (HRCA 1)	Flamholtz (1985)	DIC
1988	Human Resource Costing & Accounting (HRCA 2)	Johansson (1996)	MCM
1989	The Invisible Balance Sheet	Sveiby (1990)	MCM
1990	HR Statement	Ahonen (1998)	DIC
1992	Balanced Scorecard	Kaplan & Norton (1992)	SC
1994	Intangible Asset Monitor	Sveiby (1997)	SC
1994	Skandia Navigator™	Edvinsson & Malone (1997)	SC
1995	Holistic Accounts	Ramboll Grou (1999)	SC
1996	Citation - Weighted Patents	Dow Chemical (1996)	DIC
1996	Technology Broker	Brooking (1996)	DIC
1997	IC-Index™	Roos et al. (1997)	SC
1997	Value Added Intellectual Coefficient (VAIC™)	Pulic (1997)	ROA
1997	Economic Value Added (EVA™)	Stern Stewart & Co (1997)	ROA
1997	Calculated Intangible Value	Stewart (1997)	ROA
1998	Investor Assigned Market Value (IAMV™)	Standfield (1998)	MCM
1998	Accounting for the Future (AFTF)	Nash H. (1998)	DIC
1998	Inclusive Valuation Methodology (IVM)	McPherson (1998)	DIC
1999	Knowledge Capital Earnings	Lev (1999)	ROA
2000	Total Value Creation, TVC™	Anderson & McLean (2000)	DIC
2000	Intellectual Asset Valuation	Sullivan (2000)	DIC
2000	The Value Explorer™	Andriessen & Tissen (2000)	DIC
2000	Value Creation Index (VCI)	Baum et al. (2000)	SC
2001	Knowledge Audit Cycle	Schiuma & Marr (2001)	SC
2001	Intangible Assets Statement	Garcia (2001)	SC
2001	EFQM	Caba & Seirra (2001)	SC
2002	Meritum Guidelines	Meritum (2002)	SC
2002	Value Chain Scoreboard™	Lev (2001)	SC
2002	IC Rating™	Edvinsson (2000)	SC
2002	FiMIAM	Rodov & Leliaert (2002)	DIC/MCM
2002	Intellectus Model	Sanchez-Canizares et al. (2007)	SC
2003	IC-dVALTM	Bonfour (2003)	SC
2003	Danish Guidelines	Mouritzen, Bukh et al. (2003)	SC
2003	Public Sector IC	Bossi (2003)	SC
2004	Topplinjen / Business IQ	Sandvik (2004)	SC
2004	National Intellectual Capital Index	Bontis (2004)	SC
2004	SICAP	Bueno (2004)	SC
2004	IAbM	Japanese Ministry of Economy, Trade and Industry (2004)	SC
2007	Dynamic Monetary Model	Milost (2007)	DIC
2008	Regional Intellectual Capital Index (RICI)	Schiuma, Lerro et al.(2008)	SC
2008	EVVICAETM	McCutcheon (2008)	DIC
2009	ICU Report	Sanchez (2009)	SC



Source: Sveiby (2010)

Fig. 2：Intangible Assets Measuring Models

D. Sveiby (2010) analyzed the above 42 methods in categories of DIC, MCM, ROA and SC from the two dimensions of organizational level and monetary value. The measuring pattern of intangible capital is shown in Fig. 2.

III. LITERATURE REVIEW AND RESULTS

This study reviews the articles concerning IC measures published in *Journal of Intellectual Capital* from the initial issue in 2000 to 2013, and classifies the literature into the four categories of DIC, MCM, ROA and SC defined by Sveiby (2001).

A. DIC methods

The DIC methods try to estimate a monetary value of an intangible asset by identifying its various components. After identification, the components can be directly evaluated. The evaluation can be make individually or as an aggregated coefficient. From this method, 13 articles are derived to measure IC as shown in the Table 2:

TABLE 2: MODELS DERIVED FROM DIC METHODS

Author	Model	Description
Caddy [08]	Intellectual capital formula	Intellectual capital consists of a mixture of both intellectual assets and intellectual liabilities.
M'Phersen and Pike [34]	Inclusive valuation methodology (IVM)	The proponent of IVM is M'Phersen . It provides a bottom-up and multidimensional measurement system.
Rodov and Leliaert [39]	Financial method of intangible assets measurement (FiMIAM)	The FiMIAM builds on the advantages of most of the earlier models and links the IC value to the market valuation over and above book value.
Leliaert, Candries and Tilmans [25]	The 4-Leaf Model	The 4-leaf Model maps the 4 types of intellectual capital and as such defines clusters of structuralized IC, non-structuralized internal IC, and non-structuralized external IC.
Chen and Lin [12]	No label*	It provides frameworks to classify and isolate human capital from expenses according to cost development stages in human resources.
Carson, Ranzijn, Winefiel and Marsden [10]	"Fluid" structural capital	Draws on psychology and sociology areas to develop a model mapping employee and work group attributes and convert it into structural capital.
Byus and Lomerson [07]	No label*	Value is derived from the customer/consumer, the theoretical framework can supports the use of value based performance measures..
Andriesson [02]	The Value ExplorerTM	It is proposed by KMPG (2000) for calculating and allocating value to 5 types of intangibles: (1) Assets and endowments, (2) Skills & tacit knowledge, (3) Collective values and norms, (4) Technology and explicit knowledge, (5) Primary and management processes.

Housel and Nelson [17]	• Knowledge valuation analysis (KVA) • Technology broker model	• The KVA provides a means to count the amount of corporate knowledge, in equivalent units, required to produce the outputs of client core processes. • The technology broker model is proposed by Brooking. Value of intellectual capital of a firm is assessed based on diagnostic analysis of a firm's response to 20 questions covering Human-centred Assets, Intellectual Property Assets, Market Assets, and Infrastructure Assets 4 major components of intellectual capital.
Litschka, Markom, and Schunder [28]	The Plexus Model	It's a quantitative assessment model for intellectual capital in companies. The basic concept is the interaction between an individual and the organization she/he works for.
Milost [32]	Dynamic monetary model	It is a monetary model for evaluating employees. The value of an employee is the sum of the employee's purchase value and the value of investments in an employee, less the value adjustment of an employee.
Ståhle and Ståhle [44]	CHS (Corrado, Hulten & Sichel)	It is Developed by Corrado, Hulten and Sichel. The CHS framework includes categories Computerized Information, Innovative Property & Economic Competencies for the macro-level measurement.
Molodchik, Shakina and Bykova, [33]	Intellectual capital transformation evaluating model (ICTEM)	The ICTEM provides a holistic view of intellectual resources as companies' strategic investments and provides ostensive framework of IC analysis using a statistical approach.

B. MCM methods

The MCM measures can be understood as the calculated difference between a firm's market capitalization value and its book value. This measurement approach is useful for intra-branch benchmarking due to its monetary focus but does not provide a deeper grade of detail to the influence factors on intellectual capital. From this method, 4 articles are derived to measure IC as shown in the Table 3.

C. ROA methods

ROA methods estimates the value of the IC by the comparison of company specific returns on assets to the sector norm, the difference being averaged and then divided by the average cost of capital (WACC) or an interest rate in order to determine a value. 4 articles on this approach are presented in the Table 4.

TABLE 3: MODELS DERIVED FROM MCM METHODS

Author	Model	Description
Rodov and Leliaert [39]	Financial method of intangible assets measurement (FiMIAM)	The FiMIAM builds on the advantages of most of the earlier models and links the IC value to the market valuation over and above book value.
Housel and Nelson [17]	• Market or value-based approach • Tobin's q	• Takes the difference between the stock market value of the firm and the net market value of its assets. • Developed by Tobin James. The "q" is the ratio of the stock market value of the firm divided by the replacement cost of its assets. Changes in "q" provide a proxy for measuring effective performance or not of a firm's intellectual capital.
Sudarsanam, Sorwar, and Marr [45]	Real option models (ROM)	A valuation perspective is developed based on the real option models that have been extended from their origin in financial asset valuation to the valuation of firms' growth opportunities.
Marzo [31]	Market-to-book value (MBV)	The author offers some advancing in the understanding of the market-to-book value (MBV) gap (or ratio) as the symptom and the metrics for intellectual capital (IC) value.

TABLE 4: MODELS DERIVED FROM ROA METHODS

Author	Model	Description
Chen, Cheng and Hwang [11]	Value added intellectual coefficient (VAIC)	The proponent of VAICTM is Pulic. An equation that measures how much and how efficiently intellectual capital and capital employed create value based on the relationship to 3 major components: capital employed, human capital, and structural capital.
Housel and Nelson [17]	Residual income model	Subtracts the earnings attributable to financial and physical assets from the firm's after-tax earnings to arrive at a residual, the knowledge earnings that can be capitalized at an appropriate discount rate.
Burgman, Ross, Ballow and Thomas [06]	Future value management methodology (FVMTM)	The FVMTM provides a comprehensive management framework that is agnostic as to the form of resources being utilized and the activities that are involved in the transformation of one resource form into another on the way to achieving sustainable outcomes valued by investors.
Kujansivu and Lönnqvist [24]	Calculated Intangible Value (CIV)	The CIV is proposed by Stewart. The method is based on the assumption that a company's premium earnings, i.e. the earnings greater than those of an average company within the industry, result from the company's IC.

D. SC methods

The scorecard (SC) methods measure the various components of IC through the use of indicators and indices. The integrated nature of SCs is undermined by such non-standard metrics which are not additive within and between the various SC perspectives. 24 articles on this approach are presented in the Table 5:

TABLE 5: MODELS DERIVED FROM SC METHODS

Author	Model	Description
Allee [01]	Intangible Value Framework	The author realises the expanding impact of IC and intangible assets require expanding potential value domains to include: business relationships, human competence, internal structures, social citizenship, environmental health, and corporate identity.
Liebowitz and Suen [26]	Knowledge management metrics	It provides some metrics for helping to measure knowledge assets.
Joia [22]	Intellectual Capital Rating (ICR)	The ICR provides a framework for rating intangible capital aims to link a firm's business strategy and intellectual capital.
Low [29]	Value creation index (VCI)	The VCI combines 9 value drivers to form a single measure of non-financial performance.
Carroll and Tansey [09]	Metrics to measure human capital and structural capital	The proposed metrics provide (1)Parsimony, (2)Finite Horizon and (3)Validation 3 criteria for the development of IC measures.
Viedma [49]	Intellectual capital benchmarking system (ICBS)	The ICBS model uses benchmarking techniquesis to built on the core competencies of company A compared to that of its best world competitor company B.
Hunt [18]	Self Assessment Computer Analyzed Testing (SACAT)	The SACAT is a practical spin-off from a 20-year university research program on the ability of people to assess the correctness of their own knowledge.
Bounfour [05]	Intellectual Capital dynamic Value (IC-dVAL)	The IC-dVAL indicators from 4 dimensions of competitiveness are computed: (1)Resources and Competencies, (2)Processes, (3)Outputs, and (4)Intellectual Capital.
Palacios-Marques and Garrigos-Simon [35]	IC scale	The IC scale is a multi-item scale constructed and validated on the basis of management perceptions.
Bontis [04]	National Intellectual Capital Index (NICI)	The NICI is a modified version of the Skandia Navigator for nations. It is calculated as the average of 4 IC components : (1)Human, (2) Process, (3)Market, and (4)Renewal Capital.
Chen, Zhu, and Hong [13]	IC measuring index system	IC is classified into human capital, structural capital, innovation capital, and customer capital, and a qualitative index system for the four IC elements is designed.
Jacobsen, Hofman-Bang, and Nordby [20]	IC Rating™	It is proposed by Edvinsson. An extension of the Skandia Navigator framework incorporating ideas from the Intangible Assets Monitor; rating efficiency, renewal and risk.
Pike, Fernström, and Roos [37]	Conjoint Value Hierarchy (CVH)	The CVH measures intangible resources' contribution to value through an empirical system that models the company's intellectual capital, and later creates isomorphic curves to estimate the results.
Boedker, Guthrie and Cuganesan [03]	Intellectual Capital Value Creation (ICVC)	The ICVC framework was developed and deployed as an analytical model to facilitate the investigation of organization's intellectual capital management, measurement and reporting (ICMMR) practices.
Voelpel, Leibold, Eckhoff, Davenport, and al, e. [50]	Systemic Scorecard (SSC)	A modified version of BSC, provides a systemic perspective in measuring/managing intangible assets.
Kaplan and Norton [23]	Balanced Scorecard (BSC)	Proposed by Kaplan and Norton. A company's performance is measured by indicators covering four major focus perspectives: (1) financial perspective, (2) customer perspective, (3) internal process perspective, and (4) learning perspective. The indicators are based on the strategic objectives.
Oliver and Porta [16]	Intellectual Capital Cluster Index (ICCI)	A valuation perspective is developed based on the real option models that have been extended from their origin in financial asset valuation to the valuation of firms' growth opportunities.
Sandra M. Sánchez-Cañizares, Miguel Ángel, A. M., and Tomás López-Guzmán. [40]	Intellectus Model	It is proposed by CIC-IADE/UAM, The model is structured into 7 components, each with elements and variables. Structural capital is divided in organizational capital and technological capital. Relational capital is divided in business capital and social capital.
Schiuma, Lerro and Carlucci [41]	Regional Intellectual Capital Index (RICI)	Uses the concept of the Knoware Tree with 4 perspectives: (1)hardware, (2)netware, (3)wetware, (4)software to create a set of indicators for regions.
Lin and Edvinsson [27]	Intellectual Capital Navigator	Each indicator is standardized. The GDP (PPP) is used, through its logarithm. The data are obtained from the OCDE and IMD. The indexes are calculated by adding the selected indicators.

Paloma Sánchez, M., Elena, S., and Rocío Castrillo. [36]	ICU Report	The ICU is a result of an EU-funded project to design an IC report specifically for universities. Contains three parts: (1) Vision of the institution, (2) Summary of intangible resources and activities, (3) System of indicators.
Johanson, Skoog, Almqvist and Koga [21]	IAbM	It is proposed by Japanese Ministry of Economy, Trade and Industry . IAbM is a guideline for IC reporting introduced by the Japanese Ministry of Economy, Trade and Industry. An IAbM report should contain: (1) Management philosophy, (2) Past to present report, (3) Present to future, (4) Intellectual-asset indicators.
Ramírez [38]	• SICAP • Based on EFQM Model	• The SICAP Project, an EU funded project to develop a general IC model specially designed for public administrations and a technological platform to facilitate efficient management of the public services. The model structure identifies three main components of intellectual capital: public human capital, public structural capital and public relational capital. • Based on EFQM Model is proposed by Caba & Sierra. An IC measuring model for public sector, it integrates the elements from European Foundation Quality Management Model (EFQM) in three blocks which compose intellectual capital: human capital, structural capital and relational capital.
Grimaldi, Cricelli and Rogo [15]	Assessing and Managing the Intellectual Capital (AMIC)	A framework defines, analyses and assesses the intellectual capital value drivers (VDs) to increase the value creation of an organization. The AMIC index combines VDs distinctive features, and assesses VDs value in terms of both stock and flow analysis.

E. Advantages and Disadvantages of the Four Methods

After reviewing the literature, the advantages and disadvantages of the four measuring methods of IC, DIC, MCM, ROA, SC, are summarized below:

(1) Direct Intellectual Capital methods, DIC

Advantage

- Able to measure the IC in categories of the organization
- Able to highlight the particularity of different categories of IC
- Able to measure identified and classified IC in an easy and confirming way
- Suitable for non-profit undertakings

Disadvantage

- Not suitable for measuring of enterprise grades and comparison between enterprises
- Benchmark is hard to acquire due to the particularity of the various categories of the organization

(2) Market Capitalization Methods, MCM

Advantage

- Able to express the economical value of IC
- Suitable for measuring of enterprise grades and comparison between enterprises

Disadvantage

- Unable to measure the IC value of different categories of the organization
- Only limited to evaluation of financial currency, not suitable for non-profit undertakings

(3) Return on Assets, ROA

Advantage

- Able to express the economic value of IC
- Suitable for measuring of enterprise grades and comparison between enterprises
- Based on traditional accounting principles, easy to be understood for the financial and accounting professionals

Disadvantage

- Unable to measure the IC value of different categories of the organization
- Only limited to evaluation of financial currency, not suitable for non-profit undertakings
- Vulnerable to the adopting of interest rate and discount rate, which will obviously influence the evaluation results

(4) Scorecard Methods, SC

Advantage

- Furnish different categories of performance of the company quickly
- Able to observe the dynamic condition of the different categories of capital
- Easy-to-adjust index, benefits the detection and revision of the errors of the company procedure
- Extensive application, benefits the revision of the current policies of the company

Disadvantage

- Due to the environmental and background meaning of the measuring index, every organization has its unique measuring index. Therefore, the comparison between organizations is comparatively difficult.
- New methods, but not easily accepted by the managers or users fond of financial information.
- Creating a large quantity of materials, hard to analyze and convey the materials.

IV. CONCLUSIONS

Tangible assets such as plants and machines are indispensable to the functioning of enterprises, but intangible assets, such as proprietary technique, brand trademark, company reputation, enterprise culture and customer

relationship, play an even more important role in the successful participation of enterprises in market competition. IC, though intangible, can be quantized by proper evaluation methods, so the IC measure has always been a topical subject in this field. Although many evaluation patterns have been developed, there is still no unified standard. This is because the value of IC may vary with the different owners and purposes. Therefore, the created value should be the basis for the evaluation of IC.

Effective management depends on effective measuring. By means of various measuring models, it is possible to identify the stock of IC of enterprises and its contribution in value creation. This paper reviews the research on IC measures, provides an insight into the new concepts in the development of IC in academia and practice, and serves as a basis for exploring the driving factor for enterprise value and constructing continuous competitive edges. However, due to time factor, this paper only selects the specialized journal of IC, *Journal of Intellectual Capital* for analysis. Other good measuring patterns published in management journals are also worth continual research.

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