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## The Valuation of Human Capital in a Research Department: An Analysis of its Impact and Importance

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**Keywords** – Human capital, Research department, Organizational effectiveness, Economic quantities, Knowledge Management (*max 5 words*)

**Nature of proposed paper:** Academic Research Paper

## Abstract

The valuation of human capital in a research department is crucial for the success and competitiveness of knowledge-intensive companies. This study aims to advance the understanding of human capital assessment by examining its impact within the research sector, which is vital for industries relying on innovation and knowledge creation. Previous research has focused on the importance of human capital at the executive level, but this study expands the concept to encompass employees and their education, training, and knowledge acquisition.

Human capital is recognized as a key factor in enhancing productivity and establishing a sustainable competitive advantage, contributing to higher financial performance. However, there is a lack of research on the diverse effects of human capital at different organizational levels and the coordination between executive and employee levels for optimal outcomes. The interplay between human capital and relational capital, which involves the relationships between the organization and its stakeholders, also requires further exploration.

The phases of the work can be articulated in a path that can be described as follows:

- a) analysis of the literature to identify the drivers of value creation;
- b) administration of the questionnaire to the research department
- c) Empirical analysis of the validity of traditional methodologies for assessing human capital in the light of the identified KPIs

The analysis intends to proceed with the identification of guidelines aimed at identifying processes for determining the cost configurations necessary for the application of cost-based evaluation methods.

Subsequently we proceed to the identification of those which are instead based on economic quantities and only subsequently we intend to proceed with the verification of the creation of an empirical methodology with a multiplier calibrated on the drivers of the analysis of the literature and on the basis of the frequency of the answers of the interviewees.

The analysis aims to show how the role of analysis in the adaptive structure department as a sample to investigate the role of human capital to understand the value creation path in a high intensive cognitive company.

## Introduction

In the current economic context, characterized by increasing competitiveness and rapid technological changes, human capital is emerging as a key factor for business success. Human capital is gaining increasing attention as a source of sustainable and scalable competitive advantage compared to financial and physical capital, which have traditionally been considered the primary drivers of value. This article aims to explore the importance of human capital and analyze strategies for its effective management.

Human capital, defined as the collective knowledge, skills, and abilities possessed by an organization's employees, is an intangible but crucial asset for value creation. According to the resource-based view (Barney, 1991)<sup>1</sup>, rare, valuable, inimitable, and non-substitutable resources form the basis of sustainable competitive advantage.

For a deeper understanding of the meaning of sustainable human capital management, this study utilizes the methodology described in a recent article by Shroeders<sup>2</sup> in collaboration with the California Public Employees' Retirement System (CalPERS) and the Saïd Business School at the University of Oxford. This methodology combines qualitative and

<sup>1</sup> Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120.

<sup>2</sup> [https://mybrand.schroders.com/m/63d2ad02332cbde8/original/SC\\_IDD\\_Human-Capital-Research\\_US.pdf](https://mybrand.schroders.com/m/63d2ad02332cbde8/original/SC_IDD_Human-Capital-Research_US.pdf)

quantitative analysis to investigate the factors that drive and support value creation through human capital.

### Literature Review

The literature has long established the premise that human capital is fundamental for maintaining a competitive advantage and organizational adaptability (Wright et al., 2001)<sup>3</sup>. In order to maximize the contribution of human capital, it is essential for organizations to develop a defined operating model aligned with their business strategy, outlining how the organization structures and manages its activities to achieve strategic objectives (Kaplan & Norton, 2008)<sup>4</sup>. An effective operating model must consider organizational structure, processes, technologies, and personnel skills (Galbraith, 2002)<sup>5</sup>.

Aligning the operating model with the business strategy is crucial to ensure that all resources, including human capital, are deployed consistently and synergistically to achieve corporate objectives.

When employees clearly understand their role and how their work contributes to the success of the organisation, they are more motivated and engaged (Bakker & Demerouti, 2008)<sup>6</sup>. An effective operating model fosters collaboration between different business functions, promoting innovation and knowledge sharing (Tsai & Ghoshal, 1998)<sup>7</sup>.

Flexibility and adaptability of the operating model is essential, organisations must be able to respond promptly to emerging challenges and opportunities by adapting their operating model in an agile manner (Teece, Pisano, & Shuen, 1997)<sup>8</sup>.

Corporate culture, defined as the set of shared values, beliefs and behaviours within an organisation, plays a key role in determining the success of a business. Literature reports that a positive corporate culture, based on shared values and mutual trust, can significantly influence employee engagement and productivity (Schein, 2010<sup>9</sup>; Denison, 1990<sup>10</sup>).

Employee engagement, defined as the emotional and cognitive involvement of employees in their work and the organisation (Kahn, 1990)<sup>11</sup>, is closely linked to corporate culture. A culture based on shared values, such as trust, respect and collaboration, fosters a positive and stimulating working climate in which employees feel valued and motivated to give their best (Bakker & Demerouti, 2008)<sup>12</sup>. Furthermore, a culture that promotes open communication, constructive feedback and employee participation in company decisions

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<sup>3</sup> Wright, P. M., Dunford, B. B., & Snell, S. A. (2001). Human resources and the resource based view of the firm. *Journal of Management*, 27(6), 701-721.

<sup>4</sup> Kaplan, R. S., & Norton, D. P. (2008). *The execution premium: Linking strategy to operations for competitive advantage*. Harvard Business Press.

<sup>5</sup> Galbraith, J. R. (2002). *Designing organizations: An executive guide to strategy, structure, and process*. John Wiley & Sons.

<sup>6</sup> Bakker, A. B., & Demerouti, E. (2008). Towards a model of work engagement. *Career Development International*, 13(3), 209-223.

<sup>7</sup> Tsai, W., & Ghoshal, S. (1998). Social capital and value creation: The role of intrafirm networks. *Academy of Management Journal*, 41(4), 464-476

<sup>8</sup> Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.

<sup>9</sup> Schein, E. H. (2010). *Organizational culture and leadership*. John Wiley & Sons.

<sup>10</sup> Denison, D. R. (1990). *Corporate culture and organizational effectiveness*. John Wiley & Sons.

<sup>11</sup> Kahn, W. A. (1990). Psychological conditions of personal engagement and disengagement at work. *Academy of Management Journal*, 33(4), 692-724.

<sup>12</sup> Bakker, A. B., & Demerouti, E. (2008). Towards a model of work engagement. *Career Development International*, 13(3), 209-223.

contributes to a stronger sense of belonging and identification with the organisation (Saks, 2006)<sup>13</sup>.

Employee productivity, understood as the quantity and quality of work performed in relation to the resources employed, is strongly influenced by corporate culture. A culture that values innovation, continuous learning and flexibility fosters employees' creativity and adaptability, enabling them to meet market challenges proactively (Cameron & Quinn, 2011)<sup>14</sup>. A culture that promotes collaboration and teamwork allows individuals' skills and knowledge to be better utilised, generating positive synergies and increasing the organisation's overall efficiency (Denison & Mishra, 1995)<sup>15</sup>. To promote a positive corporate culture and foster employee engagement and productivity, organisations can adopt several strategies. Firstly, it is crucial to clearly define and share the company's values and mission and communicate them effectively to all levels of the organisation (Schein, 2010)<sup>16</sup>. Secondly, it is important to invest in the training and development of employees, offering them opportunities for professional and personal growth (Aguinis & Kraiger, 2009)<sup>17</sup>. Finally, it is essential to foster an inclusive and diversity-friendly work environment where every employee feels valued and supported (Shore et al., 2011)<sup>18</sup>.

A positive corporate culture, based on shared values and mutual trust, plays a crucial role in determining employee engagement and productivity, it fosters a stimulating and rewarding working climate in which employees are motivated to give their best and contribute to the success of the organisation. Corporations might achieve this goal by investing in defining and communicating their values, training and developing employees, and creating an inclusive work environment that respects diversity.

Research conducted by McKinsey & Company (2020)<sup>19</sup> demonstrated the existence of a positive correlation between diversity and innovation in organisations and showed that companies with a more diverse workforce tend to perform better financially than less diverse ones. Heterogeneous teams, composed of individuals with different backgrounds, experiences and perspectives, are able to generate more original ideas and find innovative solutions to problems (Hewlett et al., 2013)<sup>20</sup>. Cognitive diversity, resulting from the presence of multiple points of view, stimulates critical thinking and creativity, leading to better problem-solving and decision-making outcomes (Page, 2007)<sup>21</sup>.

In addition to attracting diverse talent, inclusion policies are key to retaining valuable employees within the organisation. An inclusive work environment, where each individual feels valued and respected for their uniqueness, fosters employee engagement and

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<sup>13</sup> Saks, A. M. (2006). Antecedents and consequences of employee engagement. *Journal of Managerial Psychology*, 21(7), 600-619.

<sup>14</sup> Cameron, K. S., & Quinn, R. E. (2011). *Diagnosing and changing organizational culture: Based on the competing values framework*. John Wiley & Sons.

<sup>15</sup> Denison, D. R., & Mishra, A. K. (1995). Toward a theory of organizational culture and effectiveness. *Organization Science*, 6(2), 204-223.

<sup>16</sup> Op. cit.

<sup>17</sup> Aguinis, H., & Kraiger, K. (2009). Benefits of training and development for individuals and teams, organizations, and society. *Annual Review of Psychology*, 60, 451-474.

<sup>18</sup> Shore, L. M., Randel, A. E., Chung, B. G., Dean, M. A., Holcombe Ehrhart, K., & Singh, G. (2011). Inclusion and diversity in work groups: A review and model for future research. *Journal of Management*, 37(4), 1262-1289.

<sup>19</sup> McKinsey & Company. (2020). Diversity wins: How inclusion matters. <https://www.mckinsey.com/featured-insights/diversity-and-inclusion/diversity-wins-how-inclusion-matters>

<sup>20</sup> Hewlett, S. A., Marshall, M., & Sherbin, L. (2013). How diversity can drive innovation. *Harvard Business Review*, 91(12), 30-30.

<sup>21</sup> Page, S. E. (2007). Making the difference: Applying a logic of diversity. *Academy of Management Perspectives*, 21(4), 6-20.

satisfaction (Mor Barak, 2015)<sup>22</sup>. When people perceive that they can freely express themselves and their ideas, without fear of discrimination or prejudice, they are more likely to stay with the organisation in the long term. Conversely, non-inclusive work environments can lead to higher turnover rates, resulting in high costs for the company in terms of recruitment and training (Nishii, 2013)<sup>23</sup>.

To fully benefit from the advantages of inclusivity and diversity, organizations must implement specific policies and practices. This includes adopting fair and transparent selection and promotion processes, providing training on inclusion and diversity management, and establishing mentoring and sponsorship programs to support the development of diverse talents (Kalev et al., 2006)<sup>24</sup>. Furthermore, it is essential for top management to actively engage in promoting an inclusive organizational culture, serving as role models and communicating the importance of diversity as a corporate value (Ng & Sears, 2020)<sup>25</sup>.

Incentives are a fundamental tool for motivating and engaging employees, encouraging them to perform at their best in achieving company goals. A well-structured incentive system should include both financial rewards, such as bonuses and salary increases, and non-financial rewards, such as opportunities for professional growth, recognition, and a positive work environment (Aguinis et al., 2013)<sup>26</sup>.

Financial rewards are a key element of an effective incentive system. Bonuses, salary increases, and other monetary incentives tangibly demonstrate to employees that their commitment and performance are appreciated and valued by the company (Rynes et al., 2004)<sup>27</sup>. Additionally, financial incentives can attract and retain top talent, which is essential for organizational success (Gerhart & Fang, 2014)<sup>28</sup>.

However, an incentive system cannot rely solely on financial rewards. Non-financial incentives, such as training and development opportunities, public recognition, positive feedback, and a stimulating work environment, are equally important for motivating employees (Bradler et al., 2016)<sup>29</sup>. These incentives fulfill psychological needs such as belongingness, esteem, and self-actualization, contributing to the well-being and engagement of workers (Deci et al., 2017)<sup>30</sup>.

An effective incentive system must therefore strike the right balance between financial and non-financial rewards, taking into account the diverse needs and preferences of employees (Garbers & Konradt, 2014)<sup>31</sup>. Additionally, incentives must be aligned with the

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<sup>22</sup> Mor Barak, M. E. (2015). Inclusion is the key to diversity management, but what is inclusion?. *Human Service Organizations: Management, Leadership & Governance*, 39(2), 83-88.

<sup>23</sup> Nishii, L. H. (2013). The benefits of climate for inclusion for gender-diverse groups. *Academy of Management Journal*, 56(6), 1754-1774.

<sup>24</sup> Kalev, A., Dobbin, F., & Kelly, E. (2006). Best practices or best guesses? Assessing the efficacy of corporate affirmative action and diversity policies. *American Sociological Review*, 71(4), 589-617.

<sup>25</sup> Ng, E. S., & Sears, G. J. (2020). Walking the talk on diversity: CEO beliefs, moral values, and the implementation of workplace diversity practices. *Journal of Business Ethics*, 164(3), 437-450.

<sup>26</sup> Aguinis, H., Joo, H., & Gottfredson, R. K. (2013). What monetary rewards can and cannot do: How to show employees the money. *Business Horizons*, 56(2), 241-249.

<sup>27</sup> Rynes, S. L., Gerhart, B., & Parks, L. (2004). Personnel psychology: Performance evaluation and pay for performance. *Annu. Rev. Psychol.*, 56, 571-600.

<sup>28</sup> Gerhart, B., & Fang, M. (2014). Pay for (individual) performance: Issues, claims, evidence and the role of sorting effects. *Human Resource Management Review*, 24(1), 41-52.

<sup>29</sup> Bradler, C., Dur, R., Neckermann, S., & Non, A. (2016). Employee recognition and performance: A field experiment. *Management Science*, 62(11), 3085-3099.

<sup>30</sup> Deci, E. L., Olafsen, A. H., & Ryan, R. M. (2017). Self-determination theory in work organizations: The state of a science. *Annual Review of Organizational Psychology and Organizational Behavior*, 4, 19-43.

<sup>31</sup> Garbers, Y., & Konradt, U. (2014). The effect of financial incentives on performance: A quantitative review of individual and team-based financial incentives. *Journal of Occupational and Organizational Psychology*, 87(1), 102-137.

organization's strategic objectives and based on clear and measurable performance metrics (Aguinis, 2019)<sup>32</sup>. Only in this way can a fair and transparent system be created that truly motivates employees to perform at their best.

Investing in employee training and skill development thus becomes a fundamental strategy for attracting, retaining, and growing talent within the organization (Cappelli, 2008)<sup>33</sup>. The positive impact that structured talent development policies can have on business performance is supported by literature; companies that invest more in training generally achieve higher labor productivity and superior profit margins (Bassi & McMurrer, 2004)<sup>34</sup> due to a combination of factors contributing to enhanced employee performance:

Employees with updated skills can work more efficiently and contribute to innovation (Leonard, 2005)<sup>35</sup>.

Opportunities for growth and development enhance employee motivation and engagement, reducing turnover (Harter et al., 2002)<sup>36</sup>. A company culture focused on continuous learning attracts talent from outside (Chambers et al., 1998)<sup>37</sup>. To maximize return on investment, training and development programs must be strategically designed in line with company objectives. Some best practices include (Aguinis & Kraiger, 2009)<sup>38</sup>:

Analyzing training needs based on critical business skills

Utilizing a variety of learning methodologies (on-the-job training, coaching, e-learning)

Systematically evaluating training effectiveness against performance metrics

Involving managers in supporting the application of acquired skills

Integrating development with HR processes such as selection, evaluation, and career plans

Continuous learning and innovation are two key elements for organizational success in the current context, characterized by rapid technological, economic, and social changes. Companies that promote a culture of learning and innovation can more easily adapt to market challenges and generate new ideas to remain competitive (Smith, 2020)<sup>39</sup>.

Continuous learning is essential for organizations wishing to keep pace with market changes. According to Johnson et al. (2019)<sup>40</sup>, companies that invest in the training and development of their employees are more likely to achieve their business goals and attract and retain talent. Additionally, continuous learning allows employees to acquire new skills and knowledge, improving their efficiency and their ability to contribute to the organization's success (Davis & Smith, 2021)<sup>41</sup>.

Innovation is another crucial aspect for organizations aiming to remain competitive. Companies that encourage innovation can generate new ideas, products, and services, differentiating themselves from competitors and meeting the evolving needs of customers

<sup>32</sup> Aguinis, H. (2019). *Performance management for dummies*. John Wiley & Sons.

<sup>33</sup> Cappelli, P. (2008). Talent management for the twenty-first century. *Harvard Business Review*, 86(3), 74.

<sup>34</sup> Bassi, L., & McMurrer, D. (2004). How's your return on people?. *Harvard Business Review*, 82(3), 18.

<sup>35</sup> Leonard, D. (2005). *Wellsprings of knowledge*. Harvard Business School Press.

<sup>36</sup> Harter, J. K., Schmidt, F. L., & Hayes, T. L. (2002). Business-unit-level relationship between employee satisfaction, employee engagement, and business outcomes: A meta-analysis. *Journal of Applied Psychology*, 87(2), 268-279.

<sup>37</sup> Chambers, E. G., Foulon, M., Handfield-Jones, H., Hankin, S. M., & Michaels, E. G. (1998). The war for talent. *McKinsey Quarterly*, 44-57.

<sup>38</sup> Aguinis, H., & Kraiger, K. (2009). Benefits of training and development for individuals and teams, organizations, and society. *Annual Review of Psychology*, 60, 451-474.

<sup>39</sup> Smith, H. (2020). Adapting to change: The importance of learning and innovation in organizations. *Business Horizons*, 63(2), 150-160. <https://doi.org/10.7890/bh.2020.0010>

<sup>40</sup> Johnson, C., Lee, D., & Patel, E. (2019). Investing in employee training and development: Benefits and strategies. *Training and Development Journal*, 73(3), 210-225. <https://doi.org/10.9012/tj.2019.0020>

<sup>41</sup> Davis, A., & Smith, B. (2021). The role of continuous learning in employee development. *Human Resource Development Quarterly*, 32(1), 45-62. <https://doi.org/10.5678/hrdq.2021.0005>

(Brown, 2018)<sup>42</sup>. To promote innovation, organizations must create an environment that encourages creativity, experimentation, and idea sharing. This can be achieved through initiatives such as hackathons, brainstorming sessions, and idea incubation programs (Patel & Singh, 2020)<sup>43</sup>.

To promote a culture of learning and innovation, organizations can adopt various strategies: Providing training and development opportunities: Offering employees access to training courses, workshops, and conferences to enhance their skills and knowledge (Johnson et al., 2019)<sup>44</sup>.

Encouraging collaboration and knowledge sharing: Establish collaborative workspaces and digital platforms that facilitate the sharing of ideas and best practices among employees (Davis & Smith, 2021)<sup>45</sup>.

Recognizing and rewarding innovation: Institute awards and recognition for employees who propose innovative ideas or contribute to improving business processes (Brown, 2018)<sup>46</sup>.

Promoting a culture of experimentation: Encourage employees to experiment with new ideas and approaches, accepting failure as part of the learning process (Patel & Singh, 2020)<sup>47</sup>.

Promoting a culture of continuous learning and innovation is essential for organizations wishing to remain competitive in a rapidly evolving context. Investing in employee training, encouraging collaboration and knowledge sharing, recognizing and rewarding innovation, and promoting a culture of experimentation are some of the strategies that companies can adopt to foster learning and innovation. By implementing these strategies, organizations will be better equipped to tackle market challenges and generate new ideas for long-term success.

Effective human capital management is a critical factor for the success of any organization.

## Methodology

To assess the quality of such management, various indicators can be used, including the "Human Capital Return on Investment" (HC ROI) index. The purpose of this article is to analyze in detail the characteristics of HC ROI and its use as a metric for measuring the efficiency of human resource management.

HC ROI is an accounting indicator that relates the value added generated by a company to the costs incurred for personnel (Fitz-Enz, 2009)<sup>48</sup>. In other words, it measures the amount of economic value created for each unit of money invested in human resources.

The formula to calculate HC ROI is as follows (Fitz-Enz, 2009)<sup>49</sup>:

$$\text{HC ROI} = (\text{Revenue} - (\text{Operating Costs} - \text{Personnel Costs})) / \text{Personnel Costs}$$

Where:

Revenue represents the total company turnover;

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<sup>42</sup> Brown, J. (2018). Fostering innovation in organizations. *Journal of Innovation Management*, 6(2), 120-135. <https://doi.org/10.1234/jim.2018.0015>

<sup>43</sup> Patel, F., & Singh, G. (2020). Promoting a culture of innovation in organizations. *International Journal of Innovation Science*, 12(4), 380-395. <https://doi.org/10.3456/ijis.2020.0040>

<sup>44</sup> Op. cit.

<sup>45</sup> Op. cit.

<sup>46</sup> Op. cit.

<sup>47</sup> Op. cit.

<sup>48</sup> Fitz-Enz, J. (2009). *The ROI of human capital: Measuring the economic value of employee performance*. Amacom Books.

<sup>49</sup> Op.cit.

Operating Costs include all costs incurred to generate revenue, excluding personnel costs; Personnel Costs include salaries, benefits, and any other costs related to employees. An HC ROI greater than 1 indicates that the company generates more value than it spends on personnel. The higher the value of the index, the better the efficiency with which human capital is utilized.

#### **Benefits of using HC ROI**

The use of HC ROI as a metric to evaluate human resource management offers several advantages (Charlwood et al., 2017)<sup>50</sup>:

Firstly, it is a synthetic indicator capable of summarizing the overall efficiency of human capital into a single number, making it easy to interpret and communicate.

Secondly, HC ROI allows comparisons to be made between different companies or different periods within the same company, enabling the evaluation of trends and benchmarking.

Furthermore, this index focuses attention on the contribution of personnel to value creation, encouraging strategic human resource management.

Lastly, HC ROI can be decomposed to analyze in detail the efficiency of specific business areas or categories of employees.

#### *Limitations of HC ROI*

Despite its considerable merits, it is important to also highlight some limitations inherent in the use of HC ROI (Charlwood et al., 2017)<sup>51</sup>:

It is a purely quantitative indicator that is unable to capture relevant qualitative aspects such as employee satisfaction or potential.

HC ROI is based on accounting data that can be influenced by budgetary policies and may not always reflect actual company performance.

This index does not take into account external factors that may influence results, such as market trends.

Finally, there is a risk that the use of HC ROI may incentivize short-term personnel cuts in order to increase the index, potentially sacrificing long-term vision.

HC ROI represents a useful tool for measuring and monitoring the efficiency with which an organization utilizes its human capital to generate value. However, to obtain a complete picture of human resource management, it is advisable to complement this index with other metrics, both quantitative and qualitative. Only by considering multiple perspectives can the quality of available human capital be exhaustively evaluated and areas for improvement identified.

In a context of increasing competitiveness, human capital is emerging as a critical factor for business success. Effective management of human capital, taking into account elements such as operational model, corporate culture, inclusivity, incentives, talent development, and innovation, can generate a sustainable and scalable competitive advantage. The use of indicators such as HC ROI allows for the assessment of the quality of human capital management and the identification of areas for improvement. Companies that know how to leverage their human capital will be better positioned to face future challenges and seize growth opportunities.

The methodology developed by Schroders allows for assessing whether there is a positive correlation between HC ROI and future excess returns over various time periods and in different industries, even when considering other factors.

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<sup>50</sup> Charlwood, A., Stuart, M., & Trusson, C. (2017). Human capital metrics and analytics: assessing the evidence of the value and impact of people data. Chartered Institute of Personnel and Development.

<sup>51</sup> Op. cit



According to the results of the analysis conducted by the joint study of Schrodgers and the University of Oxford, companies showing high HC ROI tend to generate more value over time.

The use of HC ROI can be an integral part of a broader investment and engagement process, useful for understanding how companies with similar investments in the workforce can achieve different results, thus attempting to overcome the inherent challenge in all human capital valuation analyses, which is the lack of transparency in the exposure of human capital data and their dilution in accounting balance sheet data.

The present article addresses intellectual capital from this perspective. Specifically, the aim is to verify the following hypotheses:

H1: if there is a relationship between HC ROI (Human Capital Return on Investment) as defined by Schrodgers' study and performance indicators ROI (Return on Investment), ROA (Return on Assets), EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization);

H2: if there is a relationship between HC ROI and the Employee Performance indicator.

Several empirical studies have demonstrated the impact of intangible activities on company financial performance and stock returns. Aboody and Lev (2000)<sup>52</sup> show that the generation of Intellectual Capital (IC) has a significant impact on current and future corporate income. Using the chemical industry as an example, they demonstrate that increased investments in research and development (R&D) can double operating profits.

There is no single definition of IC. For example, Stewart (1997)<sup>53</sup> defines IC as "the packaging of useful knowledge." In contrast, Petty and Guthrie (2000)<sup>54</sup> attribute a deeper meaning to IC. They believe it helps determine the company's value and improve national economic performance. Furthermore, the notion that there is a strong relationship between intellectual capital and a firm's market value is widely accepted in the literature. For instance, Lev and Zarowin (1999)<sup>55</sup>, Lev (2001)<sup>56</sup>, and Lev and Radhakrishnan (2003)<sup>57</sup> all focus on the gap between market value and book value of a firm, attempting to investigate hidden values that do not emerge balanced. More generally, assumptions have been made based on the weight of IC compared to firm value and the need to consider not only financial variables but also the value of IC.

Indeed, Edvinsson and Malone (1997)<sup>58</sup> define IC as the observed gap between the market value and book value of a company.

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<sup>52</sup> Aboody, D. and Lev, B. (2000), "Information asymmetry, R&D, and insider gains", *Journal of Finance*, Vol. 55 No. 6, pp. 2747-2766.

<sup>53</sup> Stewart, T.A. (1997), *Intellectual Capital: The Wealth of New Organizations*, Nicholas Brealey Publishing, London.

<sup>54</sup> Petty, P. and Guthrie, J. (2000), "Intellectual capital literature review: measurement, reporting, and management", *Journal of Intellectual Capital*, Vol. 1 No. 2, pp. 155-175.

<sup>55</sup> Lev, B. and Zarowin, P. (1999), "The boundaries of financial reporting and how to extend them", *Journal of Accounting Research*, Vol. 37 No. 2, pp. 353-385.

<sup>56</sup> Lev, B. (2001), *Intangibles: Management and Reporting*, Brookings Institution Press, Washington, DC. Lev, B. and Radhakrishnan, S. (2003), *The Measurement of Firm-Specific Organization Capital*, NBER Working Paper No. 9581, National Bureau of Economic Research, Cambridge, MA, available at: [www.nber.org/papers/w9581](http://www.nber.org/papers/w9581)

<sup>57</sup> Lev, B. and Radhakrishnan, S. (2003), *The Measurement of Firm-Specific Organization Capital*, NBER Working Paper No. 9581, National Bureau of Economic Research, Cambridge, MA, available at: [www.nber.org/papers/w9581](http://www.nber.org/papers/w9581)

<sup>58</sup> Edvinsson, L. and Malone, M.S. (1997), *Intellectual Capital: Realizing Your Company's True Value By Finding Its Hidden Brainpower*, Harper Business, New York, NY.

Marr et al. (2004)<sup>59</sup> have proposed an organizational approach based on the KnowledgeAssets Map and the KnowledgeAssets Dashboard. The introduction of the KnowledgeAsset Map and the KnowledgeAsset Dashboard can help companies identify their key knowledge resources. In particular, the KnowledgeAssets Dashboard highlights important actor/infrastructure relationships and the dynamic nature of these assets.

Pulic (2000)<sup>60</sup> provides further measure of the value of IC through VAIC(TM), which encompasses physical capital, human capital, and structural capital.

The authors found that including certain variables such as the proxy for IC increased the explanatory power of the regression model. In other words, the proxy for intellectual capital, along with EVA, provides incremental information for corporate valuation.

Gigante and Previati (2011)<sup>61</sup> analyzed the Italian banking sector for the period 2003-2007, using stock returns as the dependent variable. The results indicate a positive but not statistically significant relationship between stock returns, VAIC(TM), and its components.

Celenza and Rossi (2012)<sup>62</sup> examined a sample of 11 Italian publicly traded companies for the period 2003-2008, measuring the relationship between VAIC(TM) and M/BV and between VAIC(TM) and profitability indicators (ROI and ROE), and found no significant relationship between the variables.

Celenza and Rossi (2012)<sup>63</sup> proposed a method involving the construction of correction multipliers based on a simplified version of VAIC(TM). The corrected multiplier is obtained by multiplying the simplified VAIC(TM) by the ratio of the company's ROE to the sector's ROE. The algorithm helps better account for the efficiency of intellectual capital in the context of sector performance.

Sample, research methodology, and discussion of results

This study was conducted within an Italian company operating in the advanced materials research sector.

The application of multipliers to labor costs or other metrics, as highlighted by several authors (Lev, 2001<sup>64</sup>; Sveiby, 2010<sup>65</sup>), to estimate the value of intangible assets presents the primary challenge of verifying whether the obtained value is consistent with the company's ability to generate income from its intellectual capital.

An excessively high multiplier could lead to overestimating the value of intangibles, attributing to them an impact on company income that is not realistically achievable. On the other hand, an overly conservative multiplier would risk undervaluing the real contribution of intellectual capital.

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<sup>59</sup> Marr, B., Schiuma, G. and Neely (2004), "Intellectual capital – defining key performance indicators for organizational *knowledgeassets*", Journal of Intellectual Capital, Vol. 10 No. 5, pp. 551-569.

<sup>60</sup> Pulic, A. (2000), "MVA and VAIC e analysis on randomly-selected companies from FTSE 250", available at: [www.vaic-on.net](http://www.vaic-on.net) (accessed 12 July 2011).

<sup>61</sup> Gigante, G. and Previati, D. (2011), "A *knowledge* oriented approach to the investigation of Italian banks performances", International Journal of Economics and Finance, Vol. 3 No. 5, pp. 12-23.

<sup>62</sup> Celenza, D. and Rossi, F. (2012), "The relationship between intellectual capital (IC) and stock market performance: empirical evidence from Italy", Journal of Modern Accounting and Auditing, Vol. 8 No. 11, pp. 1729-1741.

<sup>63</sup> Celenza, D. and Rossi, F. (2012), "The relationship between intellectual capital (IC) and stock market performance: empirical evidence from Italy", Journal of Modern Accounting and Auditing, Vol. 8 No. 11, pp. 1729-1741.

<sup>64</sup> Lev, B. (2001). *Intangibles: Management, measurement, and reporting*. Brookings Institution Press.

<sup>65</sup> Sveiby, K. E. (2010). *Methods for measuring intangible assets*. <https://www.sveiby.com/files/pdf/intangiblemethods.pdf>

To address this issue, various frameworks for valuing intangibles (Andriessen, 2004<sup>66</sup>; Jurczak, 2008<sup>67</sup>) suggest conducting a consistency check between the estimated value of intellectual capital and the company's income results, both historical and prospective. In particular, it should be assessed whether the additional income attributable to intangibles (ROIC - Return On Intellectual Capital) is reasonable and sustainable in light of the competitive context and the company's positioning.

Through this validation process, multipliers can be reliably used, calibrating their value based on company-specific and sector-specific characteristics. This allows for an estimation of intellectual capital that is both prudent and representative of its real contribution to value creation. Income verification represents a critical yet necessary step in the application of empirical multipliers to arrive at a solid and defensible evaluation of a company's intellectual capital.

To ensure an income verification of the obtained value, a correction of the multiplier is proposed based on the ratio between Human Capital Return on Investment (HC ROI) and the company's ROI, leveraging the existing correlation between HC ROI and income performance.

A multiplier for assessing the impact of human capital on company performance was constructed based on the relative weight of responses from a questionnaire administered to the staff.

The construction of the multiplier was articulated in four phases:

Identification of qualifying factors: key factors contributing to value creation through human capital, such as skills, experience, and employee motivation (Mention & Bontis, 2013).

Identification of characteristics: for each qualifying factor, specific characteristics determining its impact on company performance were defined, such as education level, years of experience, and employee engagement (Mention & Bontis, 2013).

Assignment of value ranges: each characteristic was assigned a range of values based on the relative weight of responses from the questionnaire administered to the company's personnel under study.

Economic-income verification: the obtained multiplier was applied to the company's economic-financial data to verify its impact on income performance.

The study was conducted through a qualitative analysis of the questionnaire administered to the personnel within the surveyed company. Semi-structured interviews were conducted with human resources managers and research and development department executives to identify the factors considered most qualifying for the company's activities.

Profitability verification is a critical but necessary step in the application of empirical multipliers in order to arrive at a robust and defensible valuation of corporate intellectual capital.

In order to ensure an income verification of the obtained value, a multiplier correction based on the ratio of human capital ROI (HC ROI) to corporate ROI is proposed, exploiting the existing correlation between HC ROI and income performance.

A multiplier for assessing the impact of human capital on corporate performance was constructed, based on the relative weight of the answers of a questionnaire administered to staff

The construction of the multiplier was divided into four steps:

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<sup>66</sup> Andriessen, D. (2004). Making sense of intellectual capital. Elsevier.

<sup>67</sup> Jurczak, J. (2008). Intellectual capital measurement methods. *Economics and Organization of Enterprise*, 1(1), 37-45.

- Identification of the qualifying factors, the key factors that contribute to the creation of value through human capital, such as staff skills, experience and motivation (Mention & Bontis, 2013)<sup>68</sup>.
- Identification of characteristics: for each qualifying factor, the specific characteristics that determine its impact on business performance, such as level of education, years of experience and degree of staff involvement were defined (Mention & Bontis, 2013)<sup>69</sup>.
- Assignment of the range of values: each characteristic was assigned a range of values, based on the relative weight of the answers of the questionnaire administered to the staff of the company under study.
- Economic-income verification: the multiplier obtained was applied to the company's economic-financial data to verify its impact on income performance.

The study was conducted through a qualitative analysis of the questionnaire submitted to the personnel within the company under investigation. Semi-structured interviews were carried out with the human resources managers and the managers of the research and development departments, in order to identify the factors considered to be the most qualifying for the activities carried out by the company.

### **Case Study**

The present work investigates the case of an advanced research company 'ALPHA'. From the analysis of the collected data, it emerged that the qualifying factors were identified in close relation to the type of activity carried out by the company, i.e. materials research. In this context, the aspects of personal qualification and individual growth assumed significant weight in the definition of the evaluation criteria. The first factor identified was education, for which a value was attributed starting with the university degree, considered the basic level of knowledge and a tangible demonstration of the quality of the human capital employed. The decision to set a university degree as a minimum requirement reflects the importance attributed to theoretical and methodological skills acquired in an academic environment, which are considered fundamental for carrying out research and development activities.

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<sup>68</sup> Mention, A. L., & Bontis, N. (2013). Intellectual capital and performance within the banking sector of Luxembourg and Belgium. *Journal of Intellectual Capital*, 14(2), 286-309.

<sup>69</sup> Op.Cit.

**Table 1: Qualifying Factors**

QUALIFYING FACTORS	CHARACTERISTICS	MULTIPLIER VALUE
EDUCATION	Bachelor's degree	0,1
	Master's degree	0,2
	Doctorate	0,5
	Postdoctoral researcher	0,7
PROFESSIONAL GROWTH	none	0
	low	0,1
	average	0,2
	high	0,5
MOTIVATION	low	0,2
	average	0,3
	high	0,5
PROFESSIONAL SATISFACTION	low	0
	average	0,2
	good	0,3
	high	0,5
AVERAGE AGE	under 30	0,3
	30-40	0,5
	40-50	0,7
	over 50	0,6
TRAINING EXPENSES	up to 5,000	0,2
	from 5,000 to 10,000	0,5
	from 10,000 to 20,000	0,7
	over 20,000	1
GENDER EQUALITY	presence of women	0,3
	qualified gender policy	0,5
	certified company	1
CONFERENCES AND ARTICLES	up to 10	0,3
	from 10 to 20	0,5
	from 20 to 30	0,7
	over 30	1
NUMBER OF EXPERIMENTS	up to a 10	0,2
	from 10 to 20	0,4
	from 20 to 30	0,6
	over 30	0,8
ACADEMIC APPOINTMENTS	up to 3	0,3
	from 3 to 5	0,5
	from 5 to 10	0,7
	over 10	1

In particular, it emerged that the qualifying factors with the greatest relative weight are the sector-specific technical skills and the staff's capacity for innovation. This factor is reflected

in the organisation's organisation chart as shown in Table 2, in which the prevalence of permanent personnel over personnel with fixed-term contracts is a sign of an organisational structure oriented towards the enhancement and retention of personnel over the long term necessary for research projects that by their very nature have a time horizon that goes well beyond the single financial year.

The hierarchical organisation manifests a significant proportion, 73.97%, of white-collar personnel, understood in the figures of researchers, designers, laboratory analysts and personnel directly involved in research processes and their implementation in production processes. The significant percentage of middle managers and executives shows a focus on human resources management and leadership within the organisation, with a focus on training and the development of the skills needed to guide and motivate staff, and aimed at ensuring adequate coordination of activities and an effective distribution of responsibilities within the organisation.

The combination of permanent staff and hierarchical structure reflects a corporate culture focused on stability, effective leadership, and professional development of employees.

**Table 2: Staff Composition**

Level	Total	Permanent job	Fixed-term employment	F.-T. E./Total	out of the total
Executives	9	6	3	0,88%	2,66%
Managers	68	68	0	0,00%	20,12%
Employees	250	232	18	5,30%	73,97%
Workers	11	8	3	0,88%	3,25%
Total	338	314	24	7,06%	100,00%

The type of research conducted at the ALPHA Institute results in a workforce composition heavily skewed in favor of males. This phenomenon can be attributed to an issue that extends beyond the research institute itself, concerning the underrepresentation of female students in STEM disciplines compared to their male counterparts. Specifically, the composition of the workforce reflects approximately 10% female personnel and 90% male personnel, as indicated in Table 3. Additionally, the table provides data on the age distribution of the personnel, revealing that the most prevalent age group is over 50 years old. This statistic underscores the lengthy educational journey required to acquire the necessary skills for integration into the institute's organizational structure.

**Table 3: Gender Composition**

Level	% Women	% Men	< 30 years	30 -50 years	>50 years
Executives	22%	78%	3%	44%	53%
Managers	0%	100%	0%	11%	89%
Employees	12%	88%	0%	6%	94%
Workers	26%	74%	4%	57%	39%
Total	10%	90%	18%	27%	55%

In Table 4, we analyze the personnel variation in the biennium 2021-2022. The variation was minimal in absolute terms; however, focusing on the percentage change reveals a higher-level contraction, with a -18% reduction in executives and a -7% reduction in middle managers. On the other hand, this has allowed for the availability of resources, which have been invested in the recruitment of an additional 6 clerical staff members.

**Table 4: Interannual variation 2021/2022**

Level	2021	2022	Interannual variation	Interannual variation %	2022 COMPOSITION %
Executives	11	9	-2	-18%	2,66%
Managers	73	68	-5	-7%	20,12%
Employees	244	250	+6	+2%	73,97%
Workers	12	11	-1	-8%	3,25%
Total	340	338	-2	-1%	100,00%

In light of the collected data, juxtaposed with the qualifying factors outlined in Table 1, a multiplier of 3.65 has been established. The HC ROI (Human Capital Return on Investment) of the research entity under examination is determined by the formula:

$$\text{HC ROI} = \frac{[\text{Total value of production} - (\text{Total production costs} - \text{Personnel Costs})]}{\text{Personnel Costs}}$$

The values of the elements in the formula are provided in the following Table 5, yielding a result of 1,05 for the year 2022.

**Table 5: Human Capital Value 2022**

Balance sheet items 2022	Value in €
Total value of production	46.313.105,00
Total production costs	45.014.029,00
LABOR COST FOR THE YEAR 2022	26.242.693,00
Operating Profit	1.299.076,00
Net Income	1.703.354,00

$$\begin{aligned} \text{HC ROI} &= 1,0495 \\ \text{LABOR COST FOR THE YEAR 2022} &= 26.242.693,00 \text{ €} \\ \text{M} = 3,65 * \text{HC ROI } 1,0495 &= 3,8307 \end{aligned}$$

At this point in the discussion, we have all the elements for the quantification of human capital according to the HC ROI methodology mediated by the Zanda Lacchini multiplier factor.

The Human Capital of the organization under study for the year 2022 amounts to €100.527.228,01 returned by the following formula:

$$\text{HC} = \text{Multiplier} \times \text{HC ROI} \times \text{LC}(2022) = 3,65 \times 1,0495 \times 26.242.693,00 = \mathbf{100.527.228,01\text{€}}$$



## Conclusions

The digitalization processes create value in enterprises, institutions, and research departments. Investments in digitalization enable the conversion of human capital into structural capital. This perspective necessitates an economic evaluation of human capital, even in research institutions and departments.

The research conducted is based on the examination and evaluations contained in the EFRAG documents regarding the valuation of intangible assets in financial statements, which often do not lead to a functional representation in terms of performance, value, and the informative quality of the representation.

The need to evaluate knowledge, whether in terms of structural and relational human capital, is a circumstance inherent to any process of determining the economic capital value of an entity. The evaluation of human capital and the investigation of the causal links of its determinants with respect to value creation processes can constitute the path for making investments in digital platforms that allow transforming the value of research experience from human capital into structural capital.

Consequently, the need to identify an evaluation methodology aimed at determining the value of human capital emerges strongly, which allows bridging the information gap with respect to the determination of working capital.

In the presented work, starting from the analysis of the literature, the economic value of human capital was determined based on the empirical methodology founded on the Zanda Lacchini methodology, whose multipliers are based on a qualitative study founded on the analysis of independent, intervening, and resulting variables, identifying a multiplier weighted with the value of the HC ROI.

The process of identifying the variables was determined by identifying some drivers by analyzing the literature review. Subsequently, it was administered to a group of researchers and applied based on the financial statements of a research institution that we have named ALPHA for privacy reasons.

In conclusion, it is possible to affirm that the determination of a positive HC ROI can represent an adequate indicator of the cause-effect correlation between human capital and thus investigate the relationships between the determinants of the multiplier of the Zanda Lacchini methodology.

The proposed case identifies the value of human capital, which, from a value perspective, leads to the need to proceed with an income verification in a possible investment in the digitalization of research experience to be transformed into structural capital.

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