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Technological Human Capital and Organizational Commitment: Evidence from Hungarian Employees

Peter Karacsony[a]*, Peter Huszka[a]

[a]J. Selye University, Bratislavská cesta 3322, 945 01 Komárno, Slovakia; [b]Széchenyi István University, Egyetem tér 1, 9026 Győr, Hungary

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ABSTRACT

In the context of digital transformation and accelerated technological development, employees' competitiveness is increasingly determined not only by professional knowledge but also by the ability to master new technologies, adapt to change, and continuously develop their competencies. This study aimed to explore how technological competencies, openness to learning, adaptability, and willingness to retrain are interrelated and how these factors influence employees' organizational commitment. The methodological basis of the study was exploratory factor analysis, evaluation of scale reliability using Cronbach's alpha, Pearson correlation analysis, and linear regression analysis. The empirical basis of the study was an online survey of 281 employees of small and medium-sized enterprises in Hungary conducted in January 2026. The results empirically supported the hypothesis that technological competence, learning orientation, adaptability, and willingness to retrain are integrated into a single adaptive technological human capital (hereinafter – ATHC) index (Cronbach's alpha = 0.837). ATHC showed a strong, positive relationship with affective organizational commitment ($r = 0.758$; $p < 0.001$) and explained 57.4% of its variance. However, a weak but significant positive relationship was found for continuance organizational commitment ($r = 0.220$; $p < 0.001$), which did not support the theoretically hypothesized negative relationship. The results indicate that developing adaptive technological human capital can not only enhance employees' employability and adaptability but also contribute to organizational competitiveness by increasing organizational commitment. Thus, in the digital economy, adaptive technological human capital is an important resource for enhancing employee resilience, strengthening organizational commitment, and ensuring long-term organizational competitiveness.

KEYWORDS: Economy, Digital Economy, Digital Transformation, Human Capital, Labor Mobility, Employee Adaptability, Retraining, Organizational Commitment

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*** Corresponding author: Karascony P.** – PhD, Professor, J. Selye University, Bratislavská cesta 3322, 945 01 Komárno, Slovakia, email: karacsonyp@ujs.sk

Технологический человеческий капитал и организационная приверженность: данные по работникам Венгрии

Карачони П.[a]*, Хузка П.[b]

[a]Университет им. Я. Селье, Братиславская дорога 3322, 945 01 Комарно, Словакия; [b]Университет им. Иштвана Сечени, площадь Университета 1, 9026 Дьёр, Венгрия

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АННОТАЦИЯ

В условиях цифровой трансформации и ускоренного технологического развития конкурентоспособность работников всё в большей степени определяется не только профессиональными знаниями, но и способностью осваивать новые технологии, адаптироваться к изменениям и непрерывно развивать компетенции. Цель данного исследования заключалась в исследовании взаимосвязи между технологическими компетенциями, открытостью к обучению, адаптивностью и готовностью к переобучению, а также в оценке влияния этих факторов на организационную приверженность работников. Методологическую основу исследования составили разведочный факторный анализ, оценка надежности шкал с использованием коэффициента альфа Кронбаха, корреляционный анализ Пирсона и линейный регрессионный анализ. Эмпирическая база исследования сформирована на основе онлайн-опроса 281 работника малых и средних предприятий Венгрии, проведенного в январе 2026 г. Результаты эмпирически подтвердили гипотезу о том, что технологическая компетентность, ориентация на обучение, адаптивность и готовность к переобучению интегрируются в единый индекс адаптивного технологического человеческого капитала, значение коэффициента альфа Кронбаха для которого составило 0,837. Индекс адаптивного технологического человеческого капитала продемонстрировал сильную положительную связь с аффективной организационной приверженностью работников ($r = 0,758$; $p < 0,001$) и объяснил 57,4% ее вариации. Вместе с тем для продолжительной организационной приверженности была выявлена слабая, но статистически значимая положительная связь ($r = 0,220$; $p < 0,001$), что не подтвердило теоретически выдвинутое предположение об отрицательном характере данной взаимосвязи. Таким образом, в условиях цифровой экономики адаптивный технологический человеческий капитал выступает значимым ресурсом повышения устойчивости работников, укрепления их организационной приверженности и обеспечения долгосрочной конкурентоспособности организаций.

КЛЮЧЕВЫЕ СЛОВА: экономика, цифровая экономика, цифровая трансформация, человеческий капитал, мобильность рабочей силы, адаптивность сотрудников, переподготовка, организационная приверженность

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*** Корреспондирующий автор: Карачони П.** – PhD, профессор, Университет им. Я. Селье, Братиславская дорога 3322, 945 01 Комарно, Словакия, email: karacsonyp@ujs.sk

INTRODUCTION

Digital transformation, automation, and the rise of knowledge-intensive economic activities have fundamentally transformed the world of work. Technological advancements are reshaping not only work processes and organizational operations but also the range of competencies expected of employees. In the modern labor market, competitiveness depends less and less on formal qualifications or professional experience alone, while skills that enable the application of new technologies, continuous learning, and adaptation to a changing work environment are becoming increasingly valuable. As a result, technological human capital has become a key resource for the competitiveness of organizations and individuals. The 2008 financial crisis, the COVID-19 pandemic, and the resulting geopolitical and economic uncertainty have highlighted that the long-term success of workers increasingly depends on their adaptability and their ability to update their skills.

The pandemic has particularly accelerated digitalization, the spread of remote work, and the rise of technology-based forms of work, while highlighting the importance of digital skills and learning flexibility. Employees who adapted quickly to the new technological environment maintained a more favorable position in the labor market and responded more effectively to changing circumstances. At the same time, technological advancements do not affect only employability. The development of competencies, the acquisition of new knowledge, and increased professional autonomy can also influence employees' relationships with the organization. In modern organizations, learning opportunities, support for competency development, and adaptation to technological advancements are increasingly important factors in fostering organizational commitment. Technological competencies can therefore be viewed not only as an economic resource but also as a factor influencing employees' integration into the organization and their long-term commitment.

Although the international literature extensively addresses issues of human capital, employability, adaptability, and organizational commitment, few empirical studies in Central and Eastern Europe analyze the combined presence of these factors. In particular, there is a lack of research in Hungary examining the relationship among technological competencies, learning orientation, adaptability, and organizational commitment as an integrated system. This study aimed to explore how technological competencies, openness to learning, adaptability, and willingness to retrain are interrelated and how these factors influence employees' organizational commitment.

LITERATURE REVIEW

Human capital theory is a defining theoretical framework in modern economics and labor market research. The basic assumption of the theory is that individuals' knowledge, skills, competencies, and experiences are resources that increase productivity, thereby creating economic value for both the individual and the organization. The concept of human capital came to the center of economic thinking in the mid-20th century, when the role of education and knowledge in explaining economic growth became increasingly evident.

According to Psacharopoulos and Schultz (1972), a significant portion of economic development cannot be explained solely by the accumulation of physical capital. They argue that investments in education, training, healthcare, and professional development can be viewed as investments that increase people's productivity and long-term income-generating capacity. The best-known proponent of human capital theory is Becker (1975), who defined human capital as an investment made in the hope of future economic returns. According to Becker, knowledge acquired through education, vocational training, and work experience increases an individual's productivity, which translates into higher earnings and a more favorable position in the labor market. One of the theory's most important conclusions is that a significant portion of the differences observed in the labor market stems from individuals' varying levels of human capital. The empirical research of Thurow and Mincer (1976) further reinforced the significance of human capital theory. The earnings function they developed showed that years spent in education and work experience have a significant impact on individuals' income. For a long time, the model served as one of the most important analytical frameworks in human capital research, and it is still frequently used to examine labor market returns.

However, globalization and the rise of the

knowledge-based economy have significantly transformed the nature of human capital. According to Drucker (1993), in the post-industrial economy, knowledge has become the most important factor of production, leading to the emergence of a new group of knowledge workers. The author emphasized that competitiveness increasingly depends on the ability to create, share, and apply knowledge, thereby giving rise to new dimensions of human capital. The rapid development of digital technologies has further strengthened this process. Autor et al. (2003) have pointed out that the spread of information technologies has fundamentally transformed the content of jobs. According to their research, routine tasks can be increasingly automated, while skills that require problem-solving, creativity, complex decision-making, and adaptability are becoming more valued. In his later work, Autor (2015) emphasized that technological progress does not primarily eliminate jobs, but transforms the content of work. As a result of technological changes, employees who can cooperate with new technologies, quickly acquire new knowledge, and adapt to changing working conditions are increasingly valuable (Novotná et al., 2023). Reports from international organizations also confirm the growing importance of technological human capital. According to the OECD (2023), digital skills, problem-solving abilities, and lifelong learning are among the most important factors for success in the labor market.

According to the World Economic Forum (2023), analytical thinking, technological knowledge, adaptability, and self-directed learning will be the most in-demand competencies in the labor market over the next decade. The acceleration of technological development has fundamentally changed the structure of competencies considered valuable in the labor market. According to van Laar et al. (2020), digital competencies extend beyond the use of IT systems to encompass complex skills such as information management, communication, collaboration, problem-solving, and critical thinking. The authors emphasize that successful functioning in a digital environment increasingly depends on the integrated application of these competencies. According to Schwab (2016), employees' success depends not only on the amount of knowledge they have but also on how quickly they can acquire new knowledge and apply it in practice. One of the most important prerequisites for adapting to technological changes is learning orientation. Learning orientation can be understood as a relatively stable individual trait that determines an individual's willingness to develop, acquire new knowledge, and expand their competencies (Noe et al., 2014). Employees with a high learning orientation are more likely to seek out new development opportunities, participate more actively in training, and adapt more easily to new job requirements. The role of lifelong learning is also emphasized by Illeris (2003), who states that in the modern economy, learning can no longer be considered a process linked to a specific life cycle. Due to rapid technological change, the continuous renewal of competencies has become a fundamental condition for success in the labor market. The willingness to learn is thus not only a tool for individual development but also a strategic resource for maintaining employability. According to Savickas's (1997) theory of career adaptability, one of the most important prerequisites for success in the modern labor market is the ability of individuals to respond to uncertainty and constant change. The author identifies four fundamental dimensions: future orientation, sense of control, curiosity, and self-confidence. Together, these enable employees to shape their careers and adapt to new circumstances actively. The importance of career adaptability has also been confirmed by the research of Rudolph et al. (2017). According to their findings, adaptability is positively associated with a willingness to learn, career success, workplace performance, and psychological well-being. Adaptive employees handle technological and organizational changes more easily and acquire new competencies more effectively. A key element of successful adaptation to technological change is the willingness to reskill. According to the OECD (2023), a significant proportion of workers will need to acquire new skills in the next decade to remain competitive in the labor market. The World Economic Forum (2023) has reached a similar conclusion, stating that a significant proportion of current jobs will require competencies that are not yet among workers' core skills.

Based on the research presented, technological competencies, learning orientation, adaptability, and willingness to retrain cannot be considered independent factors. These dimensions reinforce one another and collectively contribute to employees' ability to meet the challenges of the digital economy. Accordingly, this study interprets these factors

as part of an integrated index defined as Adaptive Technological Human Capital (ATHC). ATHC represents a complex human capital resource built on a combined system of technological readiness, openness to learning, adaptability, and willingness to develop competencies.

H1: Technological competencies, learning orientation, adaptability, and willingness to retrain form a single-factor structure suitable for the development of the ATHC index.

Organizational commitment is one of the most widely studied indicators of organizational behavior and human resource management. Research shows that committed employees perform better, are more satisfied with their work, are less likely to leave their organization, and are more willing to support organizational goals (Meyer et al., 2002). The importance of commitment has become particularly significant in the knowledge-based economy, where organizational competitiveness increasingly depends on employees' knowledge, competencies, and innovative capabilities. The best-known theoretical model of organizational commitment was developed by Meyer and Allen (1991). According to this three-component model, commitment consists of three distinct yet interrelated dimensions: affective, continuance, and normative. Affective commitment expresses the employee's emotional attachment, identification, and involvement with the organization.

Continuance commitment, in contrast, is linked to the perceived costs of leaving the organization, while normative commitment stems from a sense of moral obligation. The literature considers affective commitment to be the component most closely associated with favorable organizational outcomes. An analysis by Meyer et al. (2002) demonstrated that affective commitment shows the strongest relationship with performance, job satisfaction, and intention to remain with the organization. Organizational experiences that support an individual's development, sense of competence, and professional self-actualization play a significant role in shaping affective commitment. One of the most important theoretical explanations of the relationship between technological human capital and organizational commitment is Social Exchange Theory. According to Blau (1964), the relationship between employees and the organization is reciprocal. If the organization supports employees' development, training, and competency development, employees may reciprocate with increased commitment and positive organizational attitudes (Eisenberger et al., 1986; Wayne et al., 1997). This type of organizational support is particularly valuable in an era of rapid technological change, where ensuring continuous learning is one of the most important signs of care on the part of the organization (Gruman & Saks, 2011). The relationship between training and organizational commitment was also examined by Bartlett (2001). According to his results, employees with greater access to training and development opportunities exhibit higher levels of affective commitment. An organizational environment that supports learning can also contribute to the development of organizational commitment. According to Kyndt et al. (2009), organizations that support continuous learning and competency development experience more favorable employee attitudes and lower turnover rates. Learning opportunities related to technological development, therefore, not only develop human capital but also serve as important tools for organizational integration.

Based on the research presented, there appears to be a positive relationship between adaptive technological human capital and affective organizational commitment. Employees who possess high technological competencies, are open to learning, can adapt to change, and are willing to acquire new skills are expected to develop a stronger emotional attachment to their organization.

H2: Adaptive Technological Human Capital is positively associated with affective organizational commitment.

While affective commitment expresses an emotional attachment to the organization, continuance commitment is fundamentally based on economic and career-related considerations. According to Meyer and Allen (1991), continuance commitment stems from the employee's perception of significant costs associated with leaving the organization. These costs can be financial, professional, or social. According to Powell and Meyer (2004), employees accumulate investments in their organizations over time, such as professional relationships, organizational knowledge, or career advantages that are costly to lose. As a result, staying with an organization is not necessarily driven by emotional attachment, but by loss avoidance. Human capital theory, however, suggests that

employees with higher human capital generally have more labor market alternatives. According to Fugate et al. (2004), more advanced competencies and higher employability increase mobility opportunities, thereby potentially reducing forced attachment to the organization. Ng and Feldman (2010) reached similar conclusions, noting that employees with higher skill levels generally have greater career opportunities and are less dependent on a single employer.

Adaptive technological human capital can play a particularly important role in this process. Employees who are capable of mastering new technologies, continuously develop their competencies, and are open to retraining typically have more favorable labor market opportunities. As a result, they are less likely to remain in their current jobs solely because of the costs of leaving the organization.

H3: Adaptive Technological Human Capital is negatively correlated with continuance organizational commitment

Based on the theoretical approaches presented, technological competencies, learning orientation, adaptability, and willingness to retrain can be interpreted as a complex system of competencies that determines employees' long-term adaptability and success in the labor market. This study defines this integrated competency system as the Adaptive Technological Human Capital (ATHC) index. The ATHC is a multidimensional human capital index that encompasses technological competencies, openness to continuous learning, adaptability, and willingness to undergo retraining and skills development.

According to the theoretical model, these factors do not appear as distinct characteristics but function as part of a common adaptive human capital system. The research hypotheses suggest that this index is positively correlated with affective organizational commitment and negatively correlated with the continuance organizational commitment factor.

The theoretical model of the study is illustrated in Figure 1.

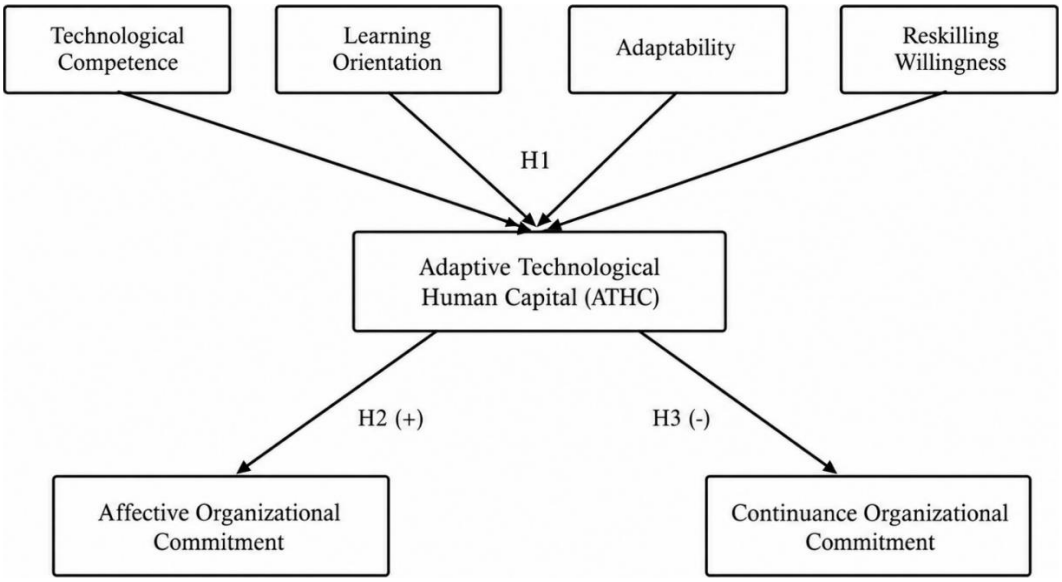

Figure 1. Conceptual research model

METHODOLOGY

Data for the study were collected in January 2026 from employees working in small- and medium-sized enterprises in Hungary. The primary objective of the study was to explore the relationships among technological competencies, learning orientation, adaptability, and willingness to retrain, and to determine whether these dimensions can be interpreted as a common adaptive technological human capital index. In addition, the research examined how this index relates to various dimensions of organizational commitment.

Data collection was conducted using an online questionnaire. Participation in the study was voluntary and anonymous. Before completing the questionnaire, respondents were informed about the purpose of the study, the confidentiality of data

handling, and the academic nature of the research. The questionnaire did not contain any personally identifiable information.

The questionnaire consisted of three main sections. The first section was designed to gather information on the respondents' demographic and employment characteristics, including gender, age, educational attainment, marital status, type of residence, length of employment, and job position. The second section focused on measuring the dimensions of adaptive technological human capital. Respondents reflected on their technological competencies, learning orientation, adaptability, and their willingness to acquire new skills and participate in retraining. The third section was designed to measure organizational commitment. The statements were based on Meyer and Allen's (1991) three-component model of commitment, with particular emphasis on the affective and continuance dimensions.

All attitude variables were measured on a seven-point Likert scale, where a score of 1 indicated complete disagreement and a score of 7 indicated complete agreement. Following data collection, a total of 281 valid questionnaires were included in the final database. During data cleaning, all responses were found to be of sufficient quality, so all respondents were included in subsequent analyses. Table 1 presents the detailed demographic characteristics of the respondents.

Table 1. Demographic characteristics of the sample

Indicator	Category	Frequency	Percent
Gender	Male	161	57.3
	Female	120	42.7
Age	18–29	141	50.2
	30–45	100	35.6
	46–60	37	13.2
	60 and older	3	1.1
Educational level	University degree	158	56.2
	High school	107	38.1
	Primary school	16	5.7
Work experience	More than 10 years	69	24.6
	5–10 years	108	38.4
	1–5 years	96	34.2
	Less than 1 year	8	2.8
Job position	White-collar job position	123	43.8
	Blue-collar job position	158	56.2

Note: compiled by the authors

Table 1 summarizes the demographic profile of the sample (N = 281). Male respondents accounted for 57.3% of the sample, while female respondents accounted for 42.7%. The majority of participants were between 18 and 29 years of age (50.2%), followed by those aged 30–45 years (35.6%). Most respondents held a university degree (56.2%), whereas 38.1% had completed high school and 5.7% had primary school education. With respect to work experience, the largest proportion of respondents reported 5–10 years of experience (38.4%), followed by 1–5 years (34.2%) and more than 10 years (24.6%). Regarding occupational status, 56.2% of respondents were employed in blue-collar positions and 43.8% in white-collar positions. This distribution indicates a relatively diverse sample across age, educational background, professional experience, and job position. Although the sample cannot be considered statistically representative of the entire Hungarian workforce due to the snowball sampling method, its diversity provides an adequate basis for exploring the index under study.

The data were analyzed using IBM SPSS Statistics software. As a first step in the analysis, we calculated descriptive statistics to present the sample's demographic characteristics and the basic characteristics of the variables under study. The paper applied exploratory factor analysis (EFA) to examine whether the variables of technological competencies, learning orientation, adaptability, and willingness to retrain were suitable for developing a common adaptive technological human capital

(hereinafter – ATHC) index. We treated affective and continuance organizational commitment as separate outcome variables in subsequent analyses.

Before conducting the factor analysis, we assessed the suitability of the data using the Kaiser–Meyer–Olkin index and Bartlett's sphericity test. In the next step, the paper assessed the internal reliability of the identified factors using Cronbach's alpha. The study used the generally accepted threshold of 0.70 to evaluate the reliability of the scales (Nunnally & Bernstein, 1994). Following the establishment of the factor structure, correlation and regression analyses were performed to explore how adaptive technological human capital relates to the various dimensions of organizational commitment.

The internal consistency of the scales was evaluated using Cronbach's alpha, and the results are reported in Table 2.

Table 2. Reliability statistics

Scale	Number of items	Cronbach's Alpha
ATHC	4	0.837
Affective Organizational Commitment	2	0.746
Continuance Organizational Commitment	3	0.713

Note: compiled by the authors

Factor analysis was conducted on the variables constituting the theoretical dimensions of ATHC. The analysis aimed to investigate whether technological competence, learning orientation, adaptability, and willingness to reskill converge into a single latent construct. Based on the results, the four variables loaded onto a single factor, providing a sound basis for constructing the ATHC index. The Cronbach's alpha value for the ATHC index was 0.837, indicating good internal reliability. The Affective Organizational Commitment scale yielded a Cronbach's alpha of 0.746, while the Continuance Organizational Commitment scale yielded an alpha of 0.713. All three values exceed the generally accepted threshold of 0.70, thereby confirming the scales' adequate reliability.

Based on the reliability results, the research data proved suitable for further hypothesis testing and empirical testing of the research model. To examine the potential impact of common method bias (CMB), Harman's single-factor test was performed (Table 3).

Table 3. Harman's Single-Factor Test (Unrotated PCA)

Statistic	Value
Number of variables included	9.000
First component eigenvalue	4.097
Variance explained by the first component, %	45.530
Threshold for common method bias assessment, %	50.000

Note: compiled by the authors

All measurement items associated with technological competence, learning orientation, adaptability, willingness to reskill, affective commitment, and continuance commitment were entered simultaneously into an unrotated principal component analysis. The first unrotated factor explained 45.53% of the total variance, which is below the 50% threshold commonly used to indicate a substantial common method bias problem (Podsakoff et al., 2003). Accordingly, common method bias is unlikely to have significantly influenced the observed relationships among the study variables.

RESULTS

The aim of the study was to examine how technological competencies, learning orientation, adaptability, and willingness to retrain are interrelated, and whether these dimensions can be interpreted as a common ATHC index. In addition, the study also examined how this index relates to various dimensions of organizational commitment. Before performing factor analysis, the suitability of the dataset for factor extraction was assessed using the Kaiser–Meyer–Olkin measure of sampling adequacy and Bartlett's test of sphericity (Table 4).

Table 4. KMO and Bartlett's Test

Measure	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.709
Bartlett's Test of Sphericity Approx. Chi-Square	529.875
Degrees of freedom	6
P-value	<0.001

Note: compiled by the authors

The suitability of the data for factor analysis was assessed using the Kaiser–Meyer–Olkin measure and Bartlett's test of sphericity. The Kaiser–Meyer–Olkin value was 0.709, indicating adequate sampling adequacy. Bartlett's test of sphericity was statistically significant ($\chi^2 = 529.875$, df = 6, $p < 0.001$), suggesting that the correlation structure among the variables was appropriate for conducting factor analysis. The principal component analysis identified a single dominant factor based on the Kaiser criterion. The aim of the analysis was to examine whether technological competence, learning orientation, adaptability, and willingness to retrain can be organized into a common ATHC index. Based on the eigenvalue analysis, a dominant factor accounted for 67.33% of the total variance. The results indicate that technological competence, learning orientation, adaptability, and willingness to retrain are closely correlated. The results support the view that the dimensions examined can be considered components of a common adaptive technological human capital index. Based on this, we created the ATHC index and used it as an independent variable in subsequent hypothesis testing.

The component matrix is presented in Table 5.

Table 5. Component matrix of ATHC Variables

Variable	Component 1
Technological competence	0.771
Adaptability	0.815
Learning orientation	0.827
Reskilling willingness	0.867

Note: compiled by the authors

The results show that all four variables have high factor loads for the first component: technological competence (0.771), adaptability (0.815), learning orientation (0.827), and readiness for retraining (0.867). Since the values of factor loads exceed the threshold of 0.700, it can be concluded that each variable is strongly related to the common factor. The results confirm that the four dimensions are collectively suitable for developing the ATHC index.

Pearson correlation analysis was conducted to examine the relationships between ATHC and the two dimensions of organizational commitment. The results are presented in Table 6.

Table 6. Correlation analysis

Variable	Adaptive Technological Human Capital	Affective Organizational Commitment	Continuance Organizational Commitment
Adaptive Technological Human Capital	1.000		
Affective Organizational Commitment	0.758***	1.000	
Continuance Organizational Commitment	0.220***	0.245***	1.000
***Correlation is significant at the 0.001 level (2-tailed)			

Note: compiled by the authors

Pearson correlation analysis revealed a strong positive association between ATHC and Affective Organizational Commitment ($r = 0.758$, $p < 0.001$). The ATHC was also positively related to Continuance Organizational Commitment ($r = 0.220$, $p < 0.001$), although this relationship was considerably weaker. Similarly, Affective Organizational Commitment showed a weak positive correlation with Continuance Organizational Commitment ($r = 0.245$, $p < 0.001$).

The results indicate a strong, positive, and

statistically significant relationship between the ATHC and affective organizational commitment ($r = 0.758$; $p < 0.001$). This suggests that employees with higher technological competence, greater openness to learning, greater adaptability, and a stronger willingness to retrain typically demonstrate a stronger emotional attachment to their organization. This result is consistent with the basic assumptions of social exchange theory (Blau, 1964) and organizational support theory (Eisenberger et al., 1986), which suggest that opportunities for development and competency development can strengthen emotional attachment to the organization.

A weaker correlation was found between the ATHC index and continuance organizational commitment ($r = 0.220$; $p < 0.001$). Although the correlation is statistically significant, its strength is considered low. This suggests that technological human capital primarily influences emotional attachment, while it has a significantly smaller effect on cost-based considerations regarding staying with the organization. An interesting finding is that the relationship is positive, even though some of the literature would have suggested a negative correlation. This is because employees with higher human capital generally have more alternatives in the external labor market, which in theory could reduce their commitment to staying with the organization. However, the results of this study suggest that employees with greater technological skills may, to some extent, place a higher value on their current workplace, and thus perceive the costs of leaving the organization as higher.

The correlation results provide preliminary support for the relationships hypothesized in the research model, but regression analyses were also conducted to examine them more precisely. To test the research hypotheses, we relied on factor analysis, correlation analysis, and linear regression. When evaluating the hypotheses, we considered not only the statistical significance, but also the practical importance and explanatory power of the relationships.

To test hypothesis H1, we used factor analysis, which is presented in Table 5. Based on the results of the factor analysis, the variables of technological competence, learning orientation, adaptability, and retraining willingness formed a common factor structure, which formed the basis for the development of the ATHC index. Based on the results of the factor analysis, technological competence, adaptability, learning orientation, and willingness to retrain were grouped into a single common factor. The first factor had a value of 2.693, explaining 67.33% of the total variance. The factor weights exceeded 0.70 for all variables, indicating a strong relationship with the common factor. Based on the results, the four dimensions proved suitable for developing the ATHC index, and H1 was empirically supported.

To test Hypothesis H2, a linear regression analysis was conducted, with Affective Organizational Commitment as the dependent variable and ATHC index as the independent variable (Table 7).

Table 7. The effect of the ATHC index on affective organizational commitment

Section	Indicator	Value
Model summary	R	0.758
	R Square	0.574
	Adjusted R-Square	0.573
	Std. Error of the Estimate	1.044
ANOVA	Regression Sum of Squares	409.882
	Residual Sum of Squares	304.023
	Total Sum of Squares	713.906
	Regression df	1
	Residual df	279
	Total df	280
	Mean Square Regression	409.882
	Mean Square Residual	1.090
	F	376.146
	Sig.	< 0.001

Coefficients	Constant: Unstandardized B	1.459
	Constant: Std. Error	0.173
	Constant: t	8.414
	Constant: Sig.	< 0.001
	ATHC: Unstandardized B	0.832
	ATHC: Std. Error	0.043
	ATHC: Standardized Beta	0.758
	ATHC: t	19.394
	ATHC: Sig.	< 0.001

Note: compiled by the authors

Based on the results, the ATHC index had a significant positive effect on affective organizational commitment (B = 0.832; β = 0.758; t = 19.394; p < 0.001). The model's explanatory power was significant ($R^2 = 0.574$), meaning that ATHC explains 57.4% of the variance in affective organizational commitment. Based on the results, Hypothesis H2 was empirically supported. The results of this study suggest that technological human capital not only creates economic value but also has significant organizational and psychological implications. The results are consistent with the research of Bartlett (2001) and Kyndt et al. (2009), which found that development opportunities, a sense of competence, and an organizational environment that supports learning strengthen employees' emotional attachment. The high correlation coefficient (r = 0.758) from the correlation analysis further confirms that the relationship between the ATHC index and affective commitment is not only statistically significant but also practically significant. Based on the results, it can be concluded that developing technological competencies and fostering a culture of learning can serve not only to increase organizational productivity but also to strengthen emotionally based organizational commitment.

Hypothesis H3 assumed that the ATHC is negatively related to continuance organizational commitment. In testing hypothesis H3, we analyzed the relationship between the ATHC and continuance organizational commitment using linear regression (Table 8).

Table 8. The effect of the ATHC index on continuance organizational commitment

Section	Indicator	Value
Model summary	R	0.220
	R Square	0.049
	Adjusted R-Square	0.045
	Std. Error of the Estimate	1.466
ANOVA	Regression Sum of Squares	30.586
	Residual Sum of Squares	599.464
	Total Sum of Squares	630.050
	Regression df	1
	Residual df	279
	Total df	280
	F	14.235
	Sig.	< 0.001
Coefficients	Constant: Unstandardized B	3.003
	Constant: Std. Error	0.243
	Constant: t	12.337
	Constant: Sig.	< 0.001
	ATHC: Unstandardized B	0.227
	ATHC: Std. Error	0.060
	ATHC: Standardized Beta	0.220
	ATHC: t	3.773
	ATHC: Sig.	< 0.001

Note: compiled by the authors

The results indicate that the ATHC had a weak but statistically significant positive effect on continuance organizational commitment (B = 0.227; β = 0.220; t = 3.773; p < 0.001). However, the model's explanatory power was low (R^2 = 0.049), meaning that the ATHC explains 4.9% of the variance in continuance organizational commitment. Since the results showed a positive relationship, while the hypothesis assumed a negative correlation, Hypothesis H3 was not empirically supported. However, the results suggest that employees with higher ATHC may perceive leaving their current job as a greater loss, which may, in turn, lead to a positive relationship with continuance organizational commitment.

A summary of the hypothesis testing results is presented in Table 9.

Table 9. Hypothesis testing summary

Hypothesis	Statement	Result	Empirical evidence
H1	Technological competence, learning orientation, adaptability, and willingness to reskill are suitable for constructing the ATHC index.	Supported	Eigenvalue = 2.693; Variance explained = 67.33%; loadings > 0.77; α = 0.837
H2	The ATHC index is positively related to affective organizational commitment.	Supported	β = 0.758; R^2 = 0.574; p < 0.001
H3	The ATHC index is negatively related to continuance organizational commitment.	Not supported	Observed relationship was positive: β = 0.220; R^2 = 0.049; p < 0.001

Note: compiled by the authors

The results show that ATHC not only emerges as a clearly identifiable and reliable index in the sample studied, but also plays a significant role in the development of organizational commitment. The strongest relationship was observed for affective organizational commitment, suggesting that technologically prepared, learning-oriented, and adaptable employees form a stronger emotional bond with their organization. This finding forms the basis for the academic and practical conclusions presented in the following chapter.

DISCUSSION

The aim of the study was to explore how technological competencies, learning orientation, adaptability, and willingness to retrain are interrelated, and to examine the role these factors play in the development of organizational commitment. Based on the study's results, two of the three hypotheses received empirical support, while Hypothesis H3 was not confirmed.

One of the most important findings of the research is that technological competencies, learning orientation, adaptability, and willingness to retrain did not emerge as separate dimensions; rather, a close relationship was observed among the examined dimensions, which enabled the development of an integrated ATHC index. This finding is consistent with the evolution of human capital theory. Becker (1975) defined human capital primarily as knowledge embodied in education, training, and professional experience. With the emergence of the digital economy, however, the scope of human capital has expanded significantly. In the modern labor market, existing professional knowledge is becoming increasingly insufficient; rather, the skills that enable continuous adaptation and learning are becoming decisive (Autor, 2015). The findings also support Savickas's (1997) career adaptability model, which posits that employees' long-term success is primarily determined by their ability to adapt to a changing environment. Fugate et al. (2004) reached similar conclusions, interpreting employability not as a static body of knowledge but as an adaptive resource system.

According to the research findings, technological competence alone is not a sufficient resource. Technological knowledge becomes a true competitive advantage only when combined with a willingness to learn, adaptability, and a focus on continuous development (Novotná et al., 2023). This is consistent with the findings of the World Economic Forum (2023), which state that resilience, flexibility, and the ability to engage in lifelong learning are among the most important competencies in the future labor market. Based on the results of Hypothesis H1, technological competence, learning orientation, adaptability, and willingness to retrain can be considered dimensions that can be organized into an integrated ATHC index.

A second key finding of the study was the identification of a strong relationship between

ATHC and affective organizational commitment. Based on the results of the correlation analysis, a strong positive relationship was found between the two variables ($r = 0.758$; $p < 0.001$), while according to the regression model, ATHC explained 57.4% of the variance in affective commitment. This result indicates that technologically competent, learning-oriented, and adaptable employees develop a significantly stronger emotional attachment to their organization. The strength of this relationship suggests that technological human capital cannot be interpreted merely as an economic or productivity factor, but also has significant organizational and psychological implications. The results are closely linked to Meyer and Allen's (1991) concept of affective commitment, according to which emotional attachment to the organization is based on identification, involvement, and agreement with organizational goals. Employees with higher technological human capital are likely to cope more successfully with organizational changes, have a greater sense of competence, and evaluate their own role in the organization's operations more positively. The results also support Blau's (1964) social exchange theory. If an organization supports its employees' development, training, and skill enhancement, employees may reciprocate with increased commitment. Eisenberger et al. (1986) reached a similar conclusion, stating that perceived organizational support is one of the strongest predictors of affective commitment.

Based on the findings of this study, digital training, retraining programs, and an organizational culture that supports learning can not only enhance employees' skill levels but also contribute significantly to strengthening organizational commitment.

One of the most interesting findings of the study was the identification of associations related to continuance organizational commitment. Correlation analysis revealed a weak but statistically significant positive relationship between ATHC index and continuance organizational commitment ($r = 0.220$; $p < 0.001$). The results differ in part from the classical expectations derived from human capital theory. Much of the literature assumes that employees with higher human capital have more external labor market alternatives and are therefore less dependent on their current employer (Ng & Feldman, 2010). Based on this logic, one might even have expected a negative relationship. However, the results of the present study shows different findings. The positive relationship may suggest that employees with high technological human capital place greater value on their current organization, especially when they have the opportunity to utilize and further develop their competencies there. Leaving the organization in this case would not merely mean changing jobs but also the loss of professional and relational resources accumulated over a long period of time.

The results obtained differ from the expectations derived from classical human capital theory; therefore, Hypothesis H3 was not empirically supported. The positive relationship may suggest that in the Hungarian labor market, employees with high technological and adaptive competencies may possess both high employability and strong organizational commitment. Despite opportunities for market mobility, leaving the organization could represent a significant loss for them due to the loss of compensation, development opportunities, training programs, or international career paths. The results, therefore, suggest that the simultaneous presence of affective and continuance organizational commitment may be more common in Central and Eastern European labor markets than classical Western models assume.

CONCLUSIONS

The aim of this study was to examine how technological competence, learning orientation, adaptability, and willingness to retrain are related to the various dimensions of organizational commitment among Hungarian employees. Based on the results, these factors can be interpreted as components of an integrated ATHC index that significantly impacts the development of organizational commitment.

The analyses confirmed that the ATHC index has a strong positive relationship with affective organizational commitment, suggesting that employees who are open to technological development and adaptable are also more emotionally attached to their organizations. In the case of continuance organizational commitment, however, a weak positive relationship was observed, contrary to expectations. This suggests that employees with high ATHC evaluate the benefits of staying with their organization not only on emotional grounds but also based on rational considerations.

One of the most important findings of the

research is that in the Hungarian labor market, the commitment patterns of employees with high technological and adaptive competencies may differ from the relationship framework assumed by classical international models. Despite opportunities for market mobility, the simultaneous presence of emotional attachment and switching costs may result in a unique commitment structure.

The study highlights that developing ATHC is a key factor for the long-term competitiveness of organizations in the digital economy. Supporting technological competencies, continuous learning, and adaptability can not only increase employees' employability but also strengthen organizational commitment and employee retention.

Based on the findings, developing technological competencies, supporting continuous learning, and strengthening adaptability can not only improve employee performance and employability but also positively influence organizational commitment.

One of the most important practical lessons from the study is that companies need not fear that investments in developing digital skills and training employees will automatically increase turnover. On the contrary, our results show that employees who are open to technological progress and focused on learning develop a stronger emotional attachment to their organization. Providing opportunities for development can therefore serve the dual goals of competitiveness and employee retention.

The positive correlation observed for continuance organizational commitment also indicates that employees with high ATHC place significant value on the benefits provided by the organization. Competitive compensation, professional development opportunities, participation in international projects, and training programs are resources that increase employees' intention to stay. Accordingly, when designing talent management systems, organizations should pay special attention to supporting continuous competency development.

The research findings are particularly relevant for organizations undergoing digital transformation. The long-term success of technology investments depends not only on the quality of the technologies used but also on the extent to which employees can adapt to the new environment. Accordingly, organizations' competitive advantage may increasingly be based on the development of adaptive technological human capital.

AUTHOR CONTRIBUTIONS

Conceptualization and theory: PK; research design: PK and PH; data collection: PK and PH; analysis and interpretation: PK and PH; writing draft preparation: PK and PH; supervision: PK; correction of article: PK and PH; proofread and final approval of article: PK. All authors have read and agreed to the published version of the manuscript.

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Information about the authors

***Peter Karacsony** – PhD, Professor, J. Selye University, Komarno, Slovakia, email: karacsonyp@ujs.sk, ORCID ID: https://orcid.org/0000-0001-7559-0488

Peter Huszka – PhD, Associate Professor, Szechenyi Istvan University, Gyor, Hungary, email: huszkap@sze.hu, ORCID ID: https://orcid.org/0000-0001-5389-0666

Автордар туралы мәліметтер

***Карачони П.** – PhD, профессор, Университет им. Я. Селье, Комарно, Словакия, email: karacsonyp@ujs.sk, ORCID ID: https://orcid.org/0000-0001-7559-0488

Хузка П. – PhD, қауымдастырылған профессор, Сечени Иштван университеті, Дьер, Венгрия, email: huszkap@sze.hu, ORCID ID: https://orcid.org/0000-0001-5389-0666

Сведения об авторах

***Карачони П.** – PhD, профессор, Университет им. Я. Селье, Комарно, Словакия, email: karacsonyp@ujs.sk, ORCID ID: https://orcid.org/0000-0001-7559-0488

Хузка П. – PhD, ассоциированный профессор, Университет им. Сечени Иштвана, Дьер, Венгрия, email: huszkap@sze.hu, ORCID ID: https://orcid.org/0000-0001-5389-0666