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WHAT HARD SKILLS ARE REQUIRED TO BE SUCCESSFUL IN SAP AND WHY STUDY SAP? THE OPINION OF STUDENTS AT A HUNGARIAN BUSINESS UNIVERSITY

The aim of this paper is to show what hard skills are needed from the side of the users to successfully run a corporate governance system. The authors present their research results on SAP, one of the most commonly used and the most well-known ERP systems at companies. In 2024, an empirical survey was conducted at the Faculty of Foreign Trade of the Budapest University of Economics and Business Administration with the participation of 250 students on the success factors of SAP implementation. Students, who are familiar with the use of SAP integrated system because they have been studying the two logistics modules of SAP, MM-SD for at least half a year in the university's practical training framework, participated in the research. Consequently, they use SAP not only in theory but also in practice. Part of the questionnaire survey focused specifically on the hard skills needed to operate the SAP system. The results were analysed by SPSS 28. The research results show that many of the users' hard skills are very much needed, and in this respect the respondents' opinions did not differ according to gender, work experience and prior SAP knowledge.

Introduction

In recent years, several studies have been published in the field of skills and ERP relationship, stressing the important role of ERP (Enterprise resource planning systems) on the one hand. Among ERP systems, the most prominent is SAP (Systems Applications and Products in Data Processing). One of the fundamental objectives of implementing these systems is to optimise costs, prepare value-maximising decisions and support innovation.

On the other hand, only some of the published studies deal with the skills needed for SAP implementation or operation. Among those very few is dealing with the hard skills that SAP users need to have, as they must be able to master the knowledge that is required to operate such a complex system. Due to the scarcity of available studies, the authors of this article conducted a study at the Faculty of Foreign Trade of the Budapest University of Economics and Business Administration to investigate what hard skills are needed to be able to use it successfully. The research with students will highlight which hard skills they consider to be important from a user perspective.

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Literary research

Hard skills

Everyone knows that one needs the right skills and abilities to do a job. The skills themselves are usually divided into two groups: hard and soft skills.

Although Winkworth, Tregord and Glynn wrote about "*hard science*" as early as 1858 (Winkworth et al., 1858), it was not until 1951 that the US Army established a behavioural science centre (Goulet, 2023). Baker quoted that "*Whitmore defined "hard skills" as the specific tactical skills involved in operating military equipment – skills focused on "weapons of aluminum and steel"*(Baker, 2024, https://www.linkedin.com/pulse/surprising-origins-hard-soft-skills-rob-baker-fcipd-mapp-dhrue/). Then, slowly but surely, the study of skills began. While soft skills have recently come to the spotlight, it should be remembered that without the right hard skills, the job cannot be done. Végh emphasises in her article the need to develop hard skills. She thinks that these are essential skills, and they need to be kept up-to-date to be able to work on a daily basis (Végh, 2023).

Viapan defines hard skills as "*primarily professional knowledge, concrete, measurable and verifiable knowledge*" (Viapan, 2024, https://www.viapan.hu/hu/blog/allaskeresesi-tippek/hard-skill).

Regarding the hard skills required for SAP, there are few articles that partially deal with user skills, but several exist that just approach this topic from the consultancy (Teal, 2025; Hasdemir, 2023; Ansi, 2019; ERPfixers, 2022) and from the project manager side (Lad, P. & S.A., 2025; SAP blog, 2015; Abdul-Azeez et al., 2024; Goel, 2024; Balasubramanian et al., 2024).

Some articles deal with specific skills related to specific SAP projects (Venquis, 2023). In fact, a lot of articles discuss how they can improve SAP skills they already have (Kapugamaarachchi, 2024; Quora, 2025) and SAP itself offers online courses and certifications (SAP Learning, 2025). We also know from Kallio's research that the system is not easy to use: "*participants from all user groups reported problems that indicate the system is not easy to use*" (Kallio, 2021, p. 29).

In relation to users, Mahdavian and Mostakeran conducted a study in 2013 in which they looked at both hard and soft skills (Mahdavian & Mostakeran, 2013). Ayyagari (2011) wrote that it is important that students in higher education should be able to study on some ERP system to gain real-world experience. Dang, in his thesis study, concluded how to improve SAP simulation courses held for students at the JAMK University (Dang, 2024) Octavio and Falikhatun emphasise that it is important to have ERP simulation courses at the universities to preparefor later working life (Octavio et al., 2024). It should not be forgotten that there could also be some difficulties in learning ERP systems (Chen et al., 2022).

Regarding user required skills for ERP Jo has written that information and communication technology skill "*has a positive impact on adoption intention in the context of cloud ERP*" (Jo, 2023, p. 2139).

All of these target hard skills development, mainly ERP or SAP usage training for the future at universities. It is well known that SAP user trainings are also provided by several companies (Udemy, 2024; SAP, 2025). It should be also highlighted that SAP training plays an important role in the implementation of SAP, as Costin writes in his study in 2020 (Costin, 2020).

SAP integrated system

SAP is an ERP software that "*has grown from a small five-person company into a multinational corporation headquartered in Walldorf, Germany, with more than 105,000 employees worldwide*" (SAP, 2025). One of the oldest integrated systems, which are "*solutions that weave together multiple*

functions, capabilities, and solutions into a single system in such a way that the component subsystems form a functional whole" (Modern, 2025, https://digitalisfogalomtar.vallalkozzdigitalisan.hu/integralt-rendszer). For this reason, "*an integrated ERP system enables users to collaborate more effectively with other departments in performing their tasks in the ERP system*" (Vállalatirányítás, 2025).

The following table shows the history of the ERP system.

TABLE 1. STRUCTURE OF THE QUESTIONNAIRE

Year	Product
1960s	Develop MRP (Material Requirements Planning)
1970s	More and more manufacturing companies start using MRP and the first system vendors are established, SAP is founded
1980s	MRP II (Manufacturing resource planning systems) is published
1990s	ERP systems appear
2000s	Emergence of ERP II (internet enabled) systems, cloud ERPs
2010s	Machine learning, IoT.

Source: authors' own editing based on Steinmetz, 2015 (https://flexium.hu/2015/06/01/az-integralt-erp-rendszerek-rovid-tortenete/)

The table shows what was typical for which decade in the history of ERP systems. The first MRP appeared in the 1960s. According to CNC, Black and Decker was the first to use MRP in 1964 (CNC, 2016). In the 1970s, large companies such as SAP were founded and are still major players in the market. According to CNC, ERP, released in 1990, pioneered how companies began to abandon their efforts to develop back-end systems (CNC, 2016). In the 2000s, the revolutionary EPR II, cloud computing, appeared. Before that, each company bought and operated a separate server for their ERP.

It is clear that the system has changed a lot in a few decades. Users need to keep up with the changes, especially in terms of hard skills, and learning the latest technologies.

Elsharnouby has written in his master's thesis that "*finding and retaining skilled staff capable of handling the intricacies of ERP systems is a significant challenge*" (Elsharnouby, 2024, p. 23). So, it is important to know which skills, especially hard skills are needed to operate SAP to make sure that the companies have the right knowledge by selecting employees.

Shim and Shim conducted research on user perception of SAP and stated that "*users become less anxious of the system as they gain more experience with the system*" (Shim et al., 2018, p. 1). This is also understandable as anybody getting more practice in one subject will have more self-confidence in the area.

Current research is aimed at finding out what hard skills are required to work in an ERP system in today's world.

Research methodology

The authors conducted research on the operation and management of SAP in 2023 and 2024 at the Faculty of Foreign Trade of the Budapest University of Economics and Business Administration. The researchers chose this institution because for almost four years now, students have been able to learn about the operation of one of the best-known integrated systems in practical lessons. Every year, international management students take a compulsory course in corporate governance

during their third and fourth years of university by this time, they have acquired a range of professional skills and many of them are already working in the workplace. Many students who are employed also use integrated systems in their workplace, i.e. many have seen and used SAP before the course. Around 120 students take the course every six months, which introduces them to two modules of SAP. MM, for materials management, and SD, for sales and distribution, cover a very broad spectrum of logistics processes. In the practical classes, students will create their own user tasks in a test system in a test company environment. Among other things, they will learn how to manage the interface, log in to the system, create orders, deliveries, invoices and interpret management reports. The university also offers the possibility to learn the advanced training material in the super user course (about MM and SD moduls) after the basic course. This learning and practical application of the material gives students the opportunity to enter the labour market as super users or junior consultants after their university studies.

In the previous year, the researchers studied students who had taken the foundation or advanced course for a year. In the last class, the students were asked to fill in a questionnaire in which they were asked to give their opinions on the course and to report on the skills they felt they needed to successfully run the system, based on their opinions and their six months' experience.

The questionnaire was preceded by a test survey, in which five students had to fill in the questionnaire and then give their opinion on how meaningful the questions were. Since no problems of interpretation arose, the students were allowed to fill in the questions as they were. The questionnaire was available online, so the authors were not able to measure the response rate. During the last class of the course, students could fill out the questionnaire on an online platform, but only if they wanted to. Participation was voluntary. In filling in the questionnaire, the authors took care to ensure that the data could not be attributed to the respondents and emphasised in the questionnaire that the results were intended specifically for research purposes. In the final survey, 250 students responded to the questions.

The questions were essentially closed questions, based on metric and categorical variables. The questions could be divided into three groups. The first group included specific characteristics of respondents, such as gender, age, work experience and previous SAP experience. The second set of questions asked about the hard and soft skills needed to work in SAP. The authors listed a number of soft and hard skills, and respondents had to decide how important each skill was for operating an SAP system and how strong they were in that skill. The skills were typically measured on a 5-point Likert scale. Finally, the respondents were asked to rate the usefulness of SAP training. The latter questions were important to the course organizers in order to determine how useful the course material was for the students and how easy it was to learn.

Since the authors used their own questionnaire, the appropriateness of the questions was checked by a half-split method for each hypothesis. Their results are presented in the analysis of the respective hypotheses.

In this study, the researchers analyse the data along the following research questions:

What hard skills are required to successfully operate SAP and is there a difference in the assessment of these based on gender, work experience and prior knowledge of SAP?

Which hard skills have an impact on someone's ability to perform operations in the system successfully?

Why is it the best to learn SAP at university? Is there a difference of opinion on this question based on prior SAP knowledge and use?

In the light of these questions, the authors formulated the following hypotheses.

Hypothesis 1: The students in the study believe that language and computer skills are the most important skills needed to operate SAP successfully and in this regard, there were no differences in opinion among the respondents based on gender, work experience and prior SAP knowledge.

Hypothesis 2: According to the students in the study, IT skills and language and computer skills the most important factors that influence the ability to successfully perform specific system and operational operations in SAP

Hypothesis 3: The students in the study believe that the most important reason to learn SAP is to get a better job and salary, and there was no difference in opinion based on whether or not one had experience of using SAP.

Of the 250 respondents, 101 were men and 149 women. The average age of respondents was 21.8 years. 95% of respondents were third-year students, as this is typically the year in which students study SAP. 91.1% of them had previous work experience and one in five respondents was familiar with SAP before receiving. 61% of respondents had been working for a company for more than a year. The research data were analysed using SPPS version 29 and PLS4.

Research results

In order to prove the first hypothesis, the authors listed a number of hard skills for respondents, who were asked to decide which ones they thought were needed to run the system successfully. They were asked to rate these skills on a five-point Likert scale, with one being not at all typical and five being absolutely typical. The reliability of the question was checked by the researchers using a half split method and the Spearman-Brown coefficient was 0.828, which was acceptable. The authors then also examined whether there were differences in the perception of these skills with respect to gender, prior work experience and prior SAP use. For this study, the researchers used the independent samples t-test for all three variables. Where a significant difference was demonstrated, the authors also plotted the results with the highest mean value. The results are summarised in Table 2.

TABLE 2. DIFFERENCES IN SKILLS AND PERCEPTIONS OF SKILLS REQUIRED TO SUCCESSFULLY OPERATE THE SYSTEM BY GENDER, PRIOR WORK EXPERIENCE AND SAP EXPERIENCE (M, SD, P=0.05)

Skills	Code	M	SD	Gender	Work-Experience	SAP Experience
Computer user skills	O1	4.35	0.746			
English language skills	O2	4.55	0.722			
Warehousing skills	P1	3.88	0.909			
Forwarding knowns	P2	3.96	0.897			
Commercial legislation	P3	3.79	1.004	t: -2.044 df: 248 sig.: 0.020 Female: 3.90		
Knowledge of foreign trade	P4	3.90	0.956			t: 2.114 df: 248 sig.: 0.019 None: 3.98
Manufacturing skills	P5	3.50	1.007			

Skills	Code	M	SD	Gender	Work-Experience	SAP Experience
Tax knowledge	P6	3.98	0.909	t: -2.000 df: 248 sig.: 0.023 Female: 4.07		
Financial literacy	P7	4.02	0.903			
Quality assurance	P8	3.36	1.049			t:1.780 df: 248 sig.: 0.038 None: 3.42
Knowledge of Excel	IT1	3.02	1.123			t-:1.753 df: 248 sig.: 0.042 Some: 3.29
Knowledge of word processing	IT2	3.03	1.175			
Programming	IT3	2.59	1.169	t: -2.769 df: 248 sig.: 0.003 Female: 2.76		

Source: authors' own research

The data show that the most important skills needed to run a business successfully are computer literacy (M: 4.35), English language skills (M: 4.55) and financial literacy (M: 4.02), and in these cases the standard deviations were low, i.e. respondents had homogeneous opinions. Programming (M: 2.59), Excel skills (M: 3.02), and word processing skills (M: 3.03) were the least important skills that were rated as less important by the students and for these skills the standard deviation was high, i.e., there was no unanimity of opinion. The authors were also surprised by the knowledge of Excel, because reports can be extracted from SAP in Excel format, but this requires a good level of Excel. As for the difference analyses, gender differences were found between men and women in programming, tax knowledge and commercial legislation, and in these cases, women always considered the skill more important on average. The preliminary SAP experience showed that there were differences in opinion on Excel skills, quality assurance and foreign trade skills. There were no significant differences for work experience, but the results should be treated with caution here, as those with previous work experience were very over-represented in the sample. In the light of the above results, the authors accept their first hypothesis and are able to conclude that the students in the study believe that language and computer skills are the most important skills needed to operate SAP successfully and that there were no differences in opinion between respondents in this respect based on gender, work experience and prior SAP knowledge.

To prove the second hypothesis, the students were also asked to state what operations they could perform on the system at the end of the course. They had to rate the activity on a scale of one to five. One meant absolutely no and five meant absolutely yes. The Spearman-Brown coefficient was 0.747, which was adequate. Table 3 shows the mean and standard deviation of the responses for each of the actions.

TABLE 3. OPERATIONS PERFORMED BY STUDENTS IN SAP (M, SD)

Operation	Code	M	SD
I can log in to the system.	S1	4.80	0.538
I can create material in the system.	S2	4.73	0.551
I can set up suppliers.	S3	4.55	0.776
I can create customers.	S4	4.45	0.816
I can create an order in the system.	OP1	4.30	0.901
I can make deliveries in the system.	OP2	4.12	0.996
I can create invoices in the system.	OP3	4.04	1.050
I can retrieve lists from the system.	OP4	4.03	1.049

Source: authors' own research

It can be said that during the training, the students have learned the basic operations well, especially the entry into the system and the management of the master data. Less well, but they can now handle specific company processes. This knowledge can be reinforced over time when they will be able to use the system in an actual enterprise environment.

To prove the hypothesis, the authors used the structural equation model (SEM). The SEM model consists of a measurement model and a structural model. The latent variables of the model were system and master data activity, operational activity, IT skill, professional skill, and other skills. The measurement model shows the relationship between the latent variables and the indicators, while the structural model shows the relationship between the latent variables.

Researchers also label Items and latent variables with codes next to their names. These codes will also appear on the model's diagram. Table 4 summarises the data from the measurement model. The standardized factor weights should have a cut-off value of 0.5, above which it is recommended to keep the item (Haier et al., 2011). The multicollinearity of the indicators is indicated by the VIF value, which is appropriate if it is below 5. The reliability of latent variables is indicated by the Cronbach's Alpha index, which is good if it is higher than 0.7 (Hair et al, 2011). The other reliability indicator is the CR value (composite reliability) (good if the limit> 0.7) (Fawad, 2023). For convergence validity, the authors used the AVE indicator (average variance extracted) (good if the 0.7) (Fawad, 2023).

For the discriminant validity of the measurement models, the authors used cross loading. In the cross-loading test, if the difference for an item is less than 0.1, then that item should be removed from the model (Fawad, 2022). Table 4 includes the latent variables, the items, and some indicators.

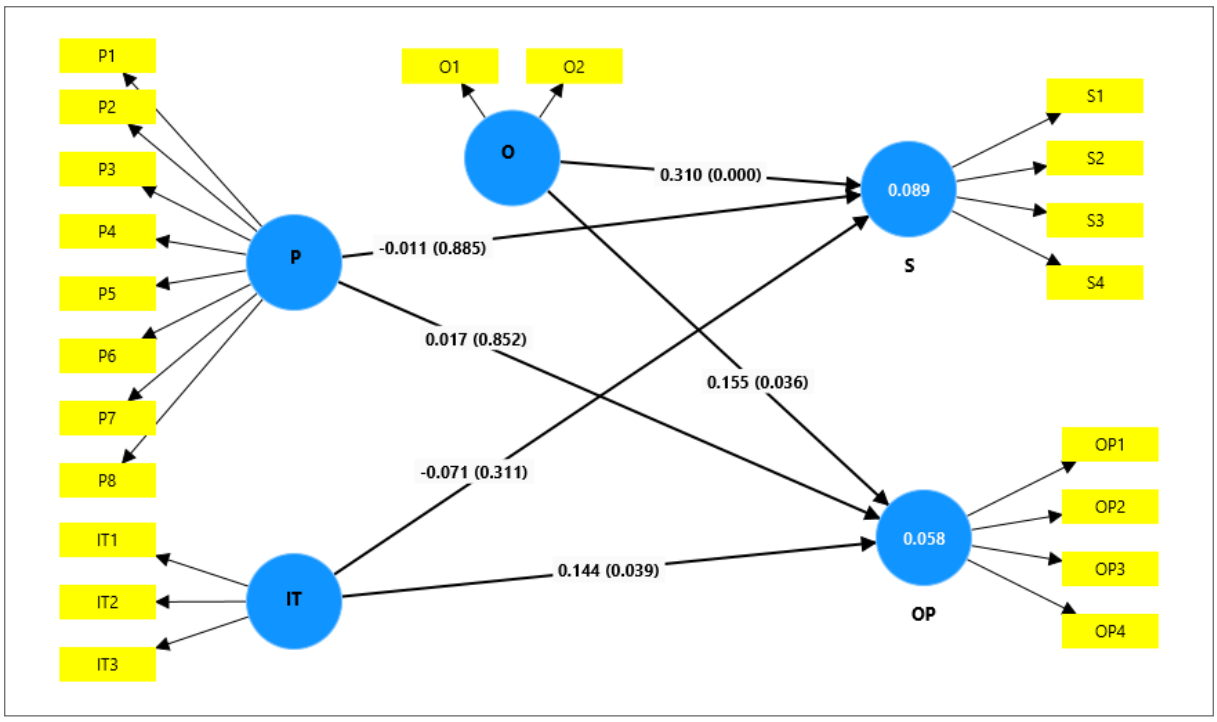
TABLE 4. CONSTRUCTS AND ITEMS (VIF, CRONBACH ALPHA, CR, AVE,)

Construct	Code	Item	Code	Factor-Weight	VIF	Cron-bach alpha	CR	AVE
System and master data activity	S	I can log in to the system.	S1	0.79	1.906	0.843	0.894	0.678
		I can create material in the system.	S2	0.869	2.370			
		I can set up suppliers.	S3	0.839	3.149			
		I can create customers.	S4	0.793	2.737			
Operational activity	OP	I can create an order in the system.	OP1	0.902	3.507	0.893	0.925	0.756
		I can make deliveries in the system.	OP2	0.880	3.995			
		I can create invoices in the system.	OP3	0.875	3.118			
		I can retrieve lists from the system.	OP4	0.818	1.911			
IT skill	IT	Knowledge of Excel	IT1	0.886	1.862	0.801	0.877	0.705
		Knowledge of word pro-cessing	IT2	0.884	1.738			
		Programming	IT3	0.742	1.612			
Professional skill	P	Warehousing skills	P1	0.896	4.474	0.919	0.932	0.633
		Forwarding known's	P2	0.872	4.624			
		Commercial legislation	P3	0.792	2.791			
		Knowledge of foreign trade	P4	0.780	2.552			
		Manufacturing skills	P5	0.739	2.57			
		Tax knowledge	P6	0.816	2.876			
		Financial literacy	P7	0.800	2.684			
		Quality assurance	P8	0.641	2.087			
Other skills	O	Computer user skills	O1	0.837	1.149	0.529	0.809	0.680
		English language skills	O2	0.812	1.149			

Source: authors' own research

The table shows that for the other skills, there was only one indicator lower than the limit (Cronbach's alpha). The researchers considered this skill important, so they left the latent variable in the model. The cross-loading test was proper, but its results are not presented due to quantitative limitations. Overall, the authors found the measurement model to be appropriate. For the structured model, the authors analysed the significant effect of the independent variables on the dependent variables. The analysis included the beta coefficient, R squared values, and p significance level. The model is presented in Figure 1.

FIGURE 1. AUTHORS' MODEL



Source: authors' own research

The authors analysed the overall effect between variables. Table 5 shows the beta value, T-statistics and significance level. The value of the T statistic is acceptable if the value is above 1.96 (Fawad, 2022). A significant relationship between variables is confirmed if the significance level p is below 0.05.

TABLE 5. TOTAL EFFECT BETWEEN VARIABLES (P=0.05)

	(β)	T statistics	P values
IT -> OP	0.144	2.062	0.039
IT -> S	-0.071	1.013	0.311
O -> OP	0.155	2.094	0.036
O -> S	0.310	4.185	0.000
P -> OP	0.017	0.187	0.852
P -> S	-0.011	0.145	0.885

Source: authors' own research

The data in the table show that there is a significant effect of other skills on the ability of learners to perform both operational and system and master data operations while IT skills only have a significant influence on operational activities. The results also confirmed that, based on the R-squared values, these skills explain only a small amount of the variation in operational (about 6%) and system – master data operations (9%).

Based on the above results, the authors can accept that the students in the study believe that IT and language and computer skills are the most important skills needed to successfully perform system and operational operations in the system.

To prove the last hypothesis, the authors provided students with several reasons why SAP is worth studying at university. On a five-point Likert scale, students were asked to rate these reasons, where one meant not at all and five meant absolutely. The Spearman-Brown coefficient value for the reliability of the question was 0.730, which was acceptable.

The mean and standard deviation of the responses are summarised in Table 6.

TABLE 6. REASONS OF WHY IT IS WORTH LEARNING SAP (M, SD)

Reasons	M	SD
It helps to give insights into IT areas.	3.94	1.058
It helps you understand how a company works.	4.30	0.870
It also shows how the different areas of the company work together.	4.34	0.802
You can use the knowledge you have acquired during my economic studies.	4.47	0.751
You can ask for a higher salary when you start working.	4.50	0.788
It is easier to get a job.	4.58	0.636

Source: authors' own research

The results show that the most important goal for learners is to succeed in the labour market, find a job easily and get a good salary. Building on previously acquired skills or knowledge is important, but still less motivating than getting a good position with SAP. The low values of the standard deviations support this. The authors investigated whether different opinions could be detected based on whether or not someone had worked with SAP before. The independent sample t-test did not confirm a significant difference for any variable. Therefore, the authors can accept their third hypothesis, i.e. that the students in the study think that SAP is most worth learning for the better job opportunities and salary, and that there was no difference in opinion on the basis of whether or not someone had previous experience of using SAP.

Discussions

The study deals with a corporate governance system that is one of the most popular in the world. The needs of the labour market show that the implementation, operation and subsequent support of this system require specific knowledge from the users who work in these systems. Literature studies show that there have been several studies analysing the skills of consultant (Teal, 2025; Hasdemir, 2023; Ansi, 2019; ERPfixers, 2022) and project manager (Lad, & S., 2025; SAP blog, 2015; Abdul-Azeez et al., 2024; Goel, 2024; Balasubramanian et al., 2024) working on projects related to the implementation of integrated systems, but very limited number of research was conducted on users, especially hard skills. As mentioned earlier Jo has executed research and stated that information and communication technology skill "*has a positive impact on adoption intention in the context of cloud ERP*" (Jo, 2023, p. 2139). Marques investigated the training and skill development need working with intelligent ERP, which uses AI (artificial intelligence). He states that to operate i-ERP not only technical skills are needed due to the AI and available advanced analysis (Marques, 2024). This gives a future possible research base that might be investigated if there were a need to change hard skills based on the need for i-ERP.

Current analysis has focused explicitly on hard skills from the users' perspective, i.e. the study is a niche study in the literature. The research has shown that although soft skills are gaining ground, hard skills play as much a primary role as soft skills in the world of integrated systems.

Conclusions

In the present study, the authors asked the students of the Budapest University of Economics and Business Administration on what the users of SAP as an ERP system should have in order to be able to operate the system.

On the one hand, the authors found that the students in the study felt that language and computer skills were the most important skills needed to operate SAP successfully regardless of gender, work experience and prior SAP knowledge.

On the other hand, the survey students said that IT and language and computer skills are the most important things needed to successfully perform system and operational operations in the system.

Finally, it was concluded that the most important goal of SAP learning is to help students succeed in the labour market. The future direction of the research will be to find out how students from other countries, who have also participated in SAP education, perceive the importance of hard and soft skills and how their opinions differ from that of Hungarian students on this issue.

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