

Game Risk Management Methods for Investment Portfolio Optimization

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Abstract: *The world is on the verge of technological revolution, which will fundamentally change the way of life, work and attitude towards each other [1]. We live in the era of the Third Industrial (or Digital) Revolution, but modern world leaders are already actively preparing for a new period - the Fourth Industrial Revolution or Industry 4.0. New forms of interaction open up opportunities in the organization of work and change requirements for employees. Business becomes digital, but the person stays. Employees will continue to remain crucial factors in innovation, continually developing products and services. The lack of talented and skilled personnel will be the main problem of the Fourth Industrial Revolution. Flexible production through FIR will require much more skills in all workflows for all employees. Skilled workers will be more in demand in the future for making decisions that can not be replaced by any algorithm. At the same time, employees must be trained and qualified for new jobs, so it is essential to review standards, for example, in education and training, and adapt them to new requirements. The implementation of interactive technologies in learning has become a necessity. One of the effective methods is business games: both independently and in combination with theoretical training. Precisely this combination (practice) is optimal for students to learn lecture material and acquire competencies. The article is devoted to the description of the technique of conducting risk management training. We described the technology of the training, dividing it into two parts. In the first part, the students are reminded of the risk management theory; in the second part, a business game is held - "Investment portfolio". In the article, we showed how it could be carried out with and without the use of gadgets/computers. As an example, we considered the most frequent mistake when conducting this game and gave a correct model. Besides, in the article, we gave formulas for automating the game of Excel.*

Index Terms: risk, probability, profitability, risk management.

I. INTRODUCTION

The use of interactive technologies in teaching significantly contributes to better learning of the lecture material and the acquisition of essential students' competences. One of the tools of interactive methods is business games. This business game is designed to secure such theoretical concepts among students:

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- risk,
- probability of an event,
- damage from a risk event,
- investments,
- profitability,
- risk management.

As a result of the game, students acquire the following competencies:

- ability to characterize the need for risk management;
- ability to justify risk management methods;
- ability to identify the main elements of the risk management system;
- ability to analyze risks;
- ability to make decisions under uncertainty;
- ability to use game theory methods in practice.

The main task of higher education is to train fully qualified competent specialists [2-3]. Students are nowadays often inattentive with typical lecture-based approaches to courses [4]. Many scholars point out that interactive learning methods have many advantages over classic lectures: make learning more interesting [5-6], increases students [7], give more concentrated thinking than lots of new information [8], create more vibrant relationship between teachers and learners, increase the activity during the learning process, and provoke teacher-student collaboration questions [9-11]. Moreover, studies prove that most of the learners may experience deeper learning as a result of the discussions that follow interactively.

II. METHODOLOGY

The training consists of two parts: in the first part, the students are reminded of the risk management theory, and in the second part, a business game is held - "Investment portfolio". This first stage takes an average of 45 minutes. Further, the teacher proceeds directly to the business game. After a theoretical excursion into risk management, the teacher gives all participants of the game four identical sheets of paper with a table (Table 1) and explains the rules. Four sheets assume that there will be four "game days", respectively, if more or fewer days are expected, the number of sheets can be reduced or increased. However, empirically, it was found that the optimal amount of game days is 3-5. If there are less than 3 of them, then students do not have time to master competencies until automatism, if more than 5, then students already start to get bored.

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Table 1. Handout for the business game "Investment portfolio"

Type of investment	Probability, %	Profitability, %	Investments, €	Insurance fee, €	Game result {1;0}	Activity result, €
I_1	50	100				
I_2	30	60				
I_3	20	40				
Amount						
Balance						
Total	200 €					

Source: Bashynska et al. (2019).

This game can also be performed using Excel (Figure 1), but in this case there will be no additional training for students' calculating abilities.

Type of investment	Probability, %	Profitability, %	Investments, €	Insurance fee, €	Game result {1;0}	Activity result, €
I_1	50	100		0		0
I_2	30	60		0		0
I_3	20	40		0		0
Amount						0
Balance						0 €
Total	200 €					

Fig. 1. Automate gameplay using Excel (source: Authors, 2019)

In this case, students fill in only green cells, further the program counts automatically.

III. RESULT

A. Excursion into risk management theory (Stage 1)

The game assumes the students have a general idea of risk management. However, the teacher briefly recalls the means and methods of risk management and focuses on the specific concepts of the game in more detail:

High-risk investments (I_1) – capital investment in investment objects (instruments), the projected return on which has a high variation (the level of risk for which significantly exceeds the market average level).

Medium-risk investments (I_2). The risk level of the investment objects of this group corresponds approximately to the market average.

Low-risk investment (I_3). They characterize capital investments in investment objects, the risk for which is significantly lower than the market average, investment returns of them approximately correspond to average market returns., low-yield investments, the yield on which is less than the average profit in the investment market

B. Game process (Stage 2). Game instructions

You are an investor. At the start of the game, you have 200

euros. You can invest them in any amount in 3 types of projects, the profitability and risk for which are different. You can also insure risks - the cost of insurance is equal to the probability of winning in this project, i.e. for medium-risk projects, the insurance fee will be 30%. In case of loss, you will return your investment.

After the student has made a decision, the teacher determines whether this project has “played” on the current game day or not.

C. An example of one "game day"

The student decided to make investments in certain projects (Table 2) and at the same time, insure them all. The student chose to invest in all 3 projects and insure all of them (the amount of insurance payment is equal to the probability of risk, that is, for the first project insurance will cost 50% of the investment amount, for the second 30%, for the third - 20%). However, in this case, it exceeds the initial budget (200 euros), since it includes investments and their insurance.

Table 2. Example of incorrect filling

Type of investment	Probability, %	Profitability, %	Investments, €	Insurance fee, €	Game result {1;0}	Activity result, €
I_1	50	100	80	40		
I_2	30	60	20	6		
I_3	20	40	80	16		
Amount			180	62		
Balance			20 €	- 42 €		
Total	200 €					

This situation is not allowed by the rules, so the student, in another way, redistributes finances (Table 3). He invested 145 euros, the amount of insurance fee amounted to 51.5 euros. The remaining amount of 6 euros goes to the next game day.

Table 3. The correct filling (source: Authors, 2019)

Type of investment	Probability, %	Profitability, %	Investments, €	Insurance fee, €	Game result {1;0}	Activity result, €
I_1	50	100	85	42,5		
I_2	30	60	30	9		
I_3	20	40	30	-		
Amount			145	51,5		
Balance			55 €	6 €		
Total	200 €					

Further calculations will be shown by the example of an automated form in Excel (Fig. 2).



	A	B	C	D	E	F	G	H	I	J
1	Type of investment	Probability, %	Profitability, %	Investments, €	Insurance fee, €	Game result (1,0)	Activity result, €	=IF(F3=1;D3+D3*C3/100;IF(E3>0;D3;0))		
2	I ₁	50	100	85	42,5	1	170	Insurance against losses =D2*B2/100		
3	I ₂	30	60	30	9	0	30	Win or lose at the end of the period =G3+G4+G5		
4	I ₃	20	40	30	0	0	0	Period result =E6+G5		
5	Amount			145	51,5		200	Announced by the teacher (host of the game) by using a smartphone app, tossing a coin, throwing a die and so on.		
6	Balance			55 €	4 €					
7	Total	200 €					204 €			
9	Initial amount minus investment amount =B7-D5			Amount of investments =D3+D4+D5		Initial amount minus investments and insurance =D5-E5				
11	Amount of insurance fees =E3+E4+E5									

Source: Bashynska et al. (2019).

Fig 2. Example of the correct filling one gaming day using Excel

The teacher, using the mobile application, announced the result of the "game" for all projects: only the first project played, the rest failed. Since the first project has a yield of 100%, so the student receives 170 euros of income. The second and third projects failed, but the student insured the second project, respectively, he returned the amount of investment (30 euros). As a result, the total income at the end of the day was 200 euros plus four unused euros, so the student started the next game day with 204 euros.

Winning in this game is determined by two categories:

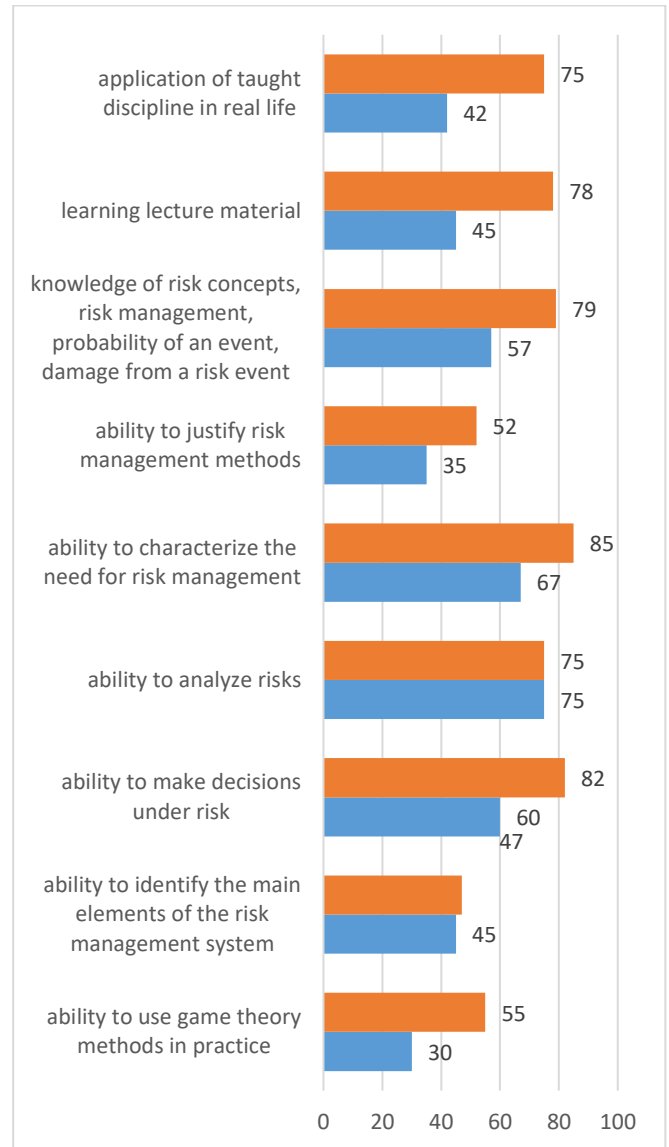
1. not go bankrupt, that is to participate in all game days;
2. get the maximum profit.

IV. CONCLUSION

This training provides students with practical skills and competencies in risk management. After it, students distinguish the concepts of probability, profitability, study the mechanism of action of insurance. This type of interactive learning involves at least two classes - a full lecture on risk management and the second lesson - training - which consists of two parts: a brief reminder of the theory and the acquisition of practical skills. In this way, memorization of the theory and the acquisition of the competencies required by a specialist are greatly enhanced.

RESULT

This methodology was tested in aggregate 18 times (12 times for masters of specialities Management, Management of Foreign Economic Activity, Management of Innovation Activity, Management of Financial and Economic Security, Economics of Enterprises and 6 times for students, raising their qualifications in the direction of "Risk Management"). Before and after the class, students answered analysis questions, and by self-analysis, such results were obtained (Fig. 3).



Source: Bashynska et al. (2019).

Fig. 3. Summary results of student self-analysis

DISCUSSION

The results of self-analysis show the effectiveness of the introduction of interactive methods in the learning process. The best results were achieved in the two most essential components of the learning process: learning lecture material and application of taught discipline in real life. The debatable question is, how appropriate is it to completely replace traditional lectures with training? We believe that training is more effective in acquiring competencies and should be applied in addition to the classical reading of theoretical material.

REFERENCES

1. Bashynska I., Malanchuk M., Zhuravel O., Olinichenko K., "Smart Solutions: Risk Management of Crypto-Assets and Blockchain Technology", *International Journal of Civil Engineering and Technology*, 10(2), pp. 1121-1131, 2019
2. Bila, O., Miziuk, V., Gumennykova, T., & Kichuk A. (2019). The Use of Modern Interactive Technologies in Learning: Correlation Analysis of the Results. *International Journal of Civil Engineering and Technology*, 10(4), 590-598.
3. Bashynska I., Filippov V., Novak N. (2018) Smart Solutions:



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- Protection NFC Cards with Shielding Plates, *International Journal of Civil Engineering and Technology*, 9(11), 1063–1071
4. Karpenko L.M., Filyppova S.V. (2016) Strategic competitive analysis of innovative enterprises development: predictive validity. *Actual Problems of Economics*, 6(180), 392-404
 5. Greener, S. (2018) Methodological choices for research into interactive learning. *Interactive Learning Environments*, 26:2, 149-150, DOI: 10.1080/10494820.2018.1436431
 6. K. Tanashchuk, K. Kovtunenکو, Yu. Kovtunenکو, Theoretical and Methodical Principles of Capital Structure Management in the Innovation Activity of Telecommunication Operators, *Journal of Automation and Information Sciences*, 50 (3), 2018, pp. 71-84. <http://10.1615/JAutomatInfScien.v50.i3.60>
 7. Peltekova, E., Dimov, A. (2016). Software architecture for interactive learning. *Proceedings of the 10th annual International Technology, Education and Development Conference*, 1117-1125
 8. Rajeshkannan, R., Ambedkar, V. (2018). Interactive learning in the classroom –not a competitor but a partner for e-learning. *Journal of Applied and Advanced Research*, 3(Suppl.1), 48-50
 9. Shah, K.A. (2017), Game-Based Accounting Learning: The Impact of Games in Learning Introductory Accounting, *International Journal of Information Systems in the Service Sector (IJISSS)*, 9(4)
 10. Prokopenko O., Holmberg R., Omelyanenko V. Information and communication technologies support for the participation of universities in innovation networks (comparative study), *Innovative Marketing*, 2018, Vol. 14, Issue № 3, pp. 17-29.
 11. Tahir, W.M.M.W., Noor I.H.M., Daud D., Hussin A.H. (2018). Towards Interactive Learning Style in Accounting: The Game Approach. *Academic Journal of Business and Social Sciences*, 2, 1-8