

# THE IMPACT OF DIGITALIZATION ON THE INCOME OF AUTHORS OF EDUCATIONAL PRODUCTS: ANALYSIS OF THE INFLUENCE OF FACTORS BASED ON FUZZY LOGIC

**Afag Huseyn**

Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan

**Elnura Shafizade**

Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan

**Sugra Humbatova**

Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan

**Tahmasib Huseynov**

Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan

## ABSTRACT

This study is devoted to considering the level of influence of some factors on the growth of teachers' incomes in the digital economy. The main research hypothesis is that qualitative and quantitative factors have a certain level of influence on the relationship between sales of digital educational products (resources) and the income of authors. The analysis in the article was carried out using the fuzzy output logic method in the MATLAB software package. Statistical data from Azerbaijan for the years 2010–2020 were used in the study. It was determined that quality indicators such as the ease of finding the digital product during the search, the availability of new information on the digital educational product, the image of the product owner, and the usefulness of the digital educational product for the buyer have a moderate to high effect on the increase of the authors' income.

**Keywords:** digital educational product; author; license; revenue; sales; fuzzy inference logic system

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## INTRODUCTION

The new information age has brought new risks to the use of digital products. The transition to online learning and online practices during the COVID-19 pandemic has affected teachers' work, learning, well-being, and resilience. Research has found that 80% of teachers and 98% of students highly appreciate the need to use digital products

in educational practice (Puchkova et al., 2021). A digital educational product is an educational product (text documents, photographs, video clips, and other educational materials) presented in electronic digital form and includes structure, subject content, and metadata about it. However, there are problems associated with digital education products, and studies show the

prevalence of so-called "technological" barriers among teachers (Ali Wahab, 2020) and the "lack of methodological developments in an interactive form" (Puchkova et al., 2020). For many teachers, digitalization in the field of education has become not only an opportunity for growth, professional development, and self-realization, but also a cause of professional and personal stress. For example, in a situation of a necessary transition to an online learning format, not all digital tools and electronic materials were available for students living in small towns (Podduba & Osipova, 2022). In our conversations with students and teachers, we noticed that, due to the digitalization measures taken, they faced many different challenges. It becomes necessary to transfer new knowledge that is able to quickly capture changes and maneuver in the digital economy, analyze large amounts of data, identify common trends, and therefore meet the requirements of a changing economic environment. The current situation requires the digitalization of the process of creating new knowledge (courses, training programs) and their transmission to students (Suleymankadieva et al., 2021).

Today, yet again, a new generation of technology platforms promise to deliver 'personalized learning' for each and every student. This rebirth of the teaching machine centers on digital software tutors (known as adaptive learning systems) and their grand claims to individualize learning by controlling the pace, place, and content for each and every student (Noeline Wright & Michael Peters, 2017).

Historically, academia has tended more toward open licenses, with a scholarly focus on shared ownership and transparency. Here, the elements and procedures of the educational product are available for free reuse by others, and the materials of the developers of educational products, such as lectures, tests, and other similar products, have been published in the scientific literature. The commercial area is more in line with a closed license. Here, the elements and how they are used are protected by copyright, and the research is the property of the authors.

There are also commercial interests in the academic realm, with some scholars charging modest fees to recoup the costs of distributing or supporting the development of new versions of educational products. On a larger scale, scientists

sell the distribution rights to their products to a publishing company or other business. Therefore, the question of the income of the producers of digital educational products in the era of the digital economy is ripe for study. Despite the fact that income from digital educational products has not been directly discussed in extensively, many often take income from the viewpoints of open and closed licenses for intellectual property rights (Rooksby et al., 2020).

Central to this is the understanding that ownership and licensing decisions can have controversial characteristics. Our study involves considering an approach where income is a motivation mechanism for producers of digital educational resources; in our case, teachers. Our main research hypothesis is that there is a certain level of influence of qualitative and quantitative factors on the relationship between sales of digital educational products (resources) and the income of authors. Therefore, we consider the following questions in this article:

- What is meant by a digital educational products of teachers, and how are they provided to the consumer?
- What factors influence the income of a manufacturer of digital educational products more?

In this article, we will try to explore the problem of the influence of various factors (reflected both in qualitative and quantitative indicators) on the growth of authors' income from sales of digital educational products. This is a main gap in scientific research and missing information that needs to be identified and used to stimulate the production and growth of sales of digital educational products in the era of digitalization of the economy.

The article is structured as follows: in the second section, we describe the relationship between open and closed licenses and the income of the manufacturer of a digital educational product, and we review the literature and point out existing research gaps. In the third section, we outline the missing statistics and research methods and use fuzzy logic based on expert reasoning. This section is followed by the results obtained. In the final section, we present conclusions, directions for further research. A list of references is included at the end.

## IMPACT OF DIGITAL EDUCATIONAL PRODUCTS AND THEIR DISTRIBUTION ON AUTHORS' INCOME

A digital educational product is an educational product (text documents, photographs, video clips, and other educational materials) presented in electronic digital form, including structure, subject content, and metadata about them.

Simultaneously with the emergence and development of the structures of the digital economy, cardinal changes in the nature of work are taking place. Speaking about the digital transformation of education, this process should be distinguished from the process of digitization. Digitization only allows for improvements to the already existing forms and formats of work and models of interactions between participants in the educational process. In the process of digitalizing the education system, a new digital educational product and new models of organization for all spheres of educational activity should be created (Chernysheva & Borisenko, 2022).

Like all products in the market for digital educational products, the price is set under the influence of supply and demand. Therefore, consumer decisions affect the income from the sale of digital educational products.

The compromise effects theory (Kahneman & Tversky, 2000; Bockstedt & Goh, 2014) explains the impact of the diversity of the choice set on consumer decision outcomes. The economics literature defines two types of search costs: external and internal (Smith et al., 1999; Bockstedt & Goh, 2014), where external search costs are associated with acquiring information and internal search costs are associated with processing acquired information. Also, costs are closely related to the concept of bounded rationality (Simon, 1996; Bockstedt & Goh, 2014) in decision-making.

Consumers' external search costs for discovering product information have been reduced using IT (Bockstedt & Goh, 2014).

At the same time, it has been revealed that the higher the level of material support for the subject, the higher the level of its digital capital. By digital capital, we mean the totality of knowledge, skills, and intellectual resources that allow one to extract additional profit from the

process of using digital technologies. At the present stage, there is a wide variety of definitions of digital capital, with different foci of consideration depending on the objectives of the study (Vartanova, 2021). The amount of digital capital is associated with social achievement, professional success, opportunities for self-realization, active participation in public life, etc. (Ragnedda, 2018; Van Deursen & Van Dijk, 2019).

Online educational marketplace websites have emerged as commercial platforms where educators self-publish original materials to virtual stores (Siedel & Stylianides, 2018; Shelton et al., 2020; Koehler et al., 2020; Shelton et al., 2021). On one hand, educational marketplaces offer teachers novel opportunities as curriculum writers (Hodge et al., 2019).

Quantitative and qualitative indicators of labor productivity both affect teachers' income. At the same time, quantitative indicators are understood as the results of fulfilling a certain educational and methodological load for a year, which is economically justified and normatively approved at the university. Qualitative indicators are related to the level of performance of work that is digital, labor-intensive, and aimed at fulfilling the monitoring indicators of an educational organization. High-quality work performance is subject to additional incentives, which are sometimes reflected in employees' contracts (Tsyokhla & Orlova, 2022).

The range of ways and mechanisms for finding types of employment, work, and partners is growing. Online educational marketplaces have advanced some opportunities for teacher leadership and collaboration, along with offering new ways for teachers to profit from their professional expertise (Torphy & Drake, 2019; Shelton & Archambault, 2020; Koehler et al., 2020; Shelton et al., 2021).

For example, the publisher John Wiley & Sons (see <http://customselect.wiley.com>) allows teachers to create customized books that combine content from multiple sources (Bockstedt & Goh, 2014). Competing platforms such as Amazon Ignite have entered the U.S. market, while TES, Twinkl, and Lehrer Marktplatz have been established in the European market (Siedel & Stylianides, 2018; Shelton et al., 2020; Koehler et al., 2020; Shelton et al., 2021). TeachersPayTeachers.com (TpT) platform, designed for profit, earns 20% of most sales (Shelton et al., 2020; Koehler et al., 2020; Shelton

et al., 2021) and shows that 87.9% of the 4,018,173 offered resources on the site were priced \$5 or under, with 15.0% (of the total) offered for free. The average TpT resource cost for non-free items was \$4.38, and the average transaction for non-free items was \$8.28, indicating that free and low-cost resources were downloaded more often. Indeed, across TpT's 1,530,382,712 downloads, 69.1% were of free resources. With \$3.9 billion in sales and sales growing each year, TpT appears to be generating notable profits (Koehler et al., 2020; Shelton et al., 2021).

### LITERATURE REVIEW

We found a great deal of literature on teacher income and motivation, but little empirical research specifically on the income of digital education product authors, as well as literature directly addressing the impact of digital market factors on the income, cost, quality, and adaptability of widely used digital education products such as curricula, lectures, and tests. We did not find literature directly devoted to fuzzy logic analysis of the factors influencing the growth of sales and revenues of manufacturers of digital educational products.

With all the obviousness of the need to use digital products and technologies in education, it should be noted that the subjects of the educational process (teachers and students) can understand the goals and forms of their use in different ways (Puchkova et al., 2021).

But it also became clear that there is an appetite for high-quality open-access digital teaching and learning materials (Eivers & Ghosh, 2020; Marcus-Quinn & Hourigan, 2022). In designing new models of basic educational programs, the main solution is to overcome the internal competition of educational programs for resources. According to the heads of psychological services, resource limitations are the key limitation to their successful work (Sukhanova & Terentyeva, 2023). Some telecommunications companies have offered free or heavily subsidized Internet packages for students and teachers and have exempted websites containing open educational resources from data charges. Teachers have noted the opportunity to improve their professional level (31%), and the use of modern teaching methods (22%), is among the important advantages. And for students, important positive factors are the

opportunity to study at an individual pace (37%), and the possibility of diversified development (31%) (Bondarenko et al., 2017). The "University National Education Quality Initiative" conducted a survey at the end of 2022, and more than 3,000 graduates from 220 universities and more than 5,000 teachers from 60 universities took part in it. The survey found that 82% of graduates, 81% of teachers, and 85% of parents consider information about university resources necessary. Another problematic field is the portfolio of educational programs (Shcheglova & Dremova, 2022). In using the resources of the digital educational environment, an important condition is the functional readiness of teachers to use digital resources to ensure the quality of education (Podduba & Osipova, 2022). The amount of explicit knowledge in digital form available to mankind at the present time is about 25 million conditional books that carry great value. In order to put them into practice, it is necessary to train about 70,000 narrow professional groups of specialists. The peculiarities of this digital content are that there both is a lot of it and that it is far from always ready for educational purposes. The development of this type of educational content requires significant investment and a systematic approach to its implementation (Orekhov et al., 2018). Motivation and self-efficacy are important individual factors; "as teachers succeed in their work, this increases their self-efficacy, which then leads to greater perseverance" (Beltman et al., 2011). As a result, the idea of the digital transformation of education is not an idea about equality and justice, it is an idea about competition (Komleva, 2021).

Education policy scholars can consider the specific circumstances of individual cases to assess the strengths of open licensing and closed licensing, or a combination of both, in terms of cost, quality, and adaptability of educational products. At the same time, it is necessary to take into account the importance of a balance of interests (Gordon & Superfine, 2020). On the one hand, consumers want access to low-cost, high-quality goods; on the other hand, there is an interest in the developers of these products to recover costs and make a profit (Ageev et al., 2017). A compromise is considered to be a balance between the interests underlying the protection of intellectual property rights and the requirements of a digital society. Intellectual property scholars are turning their attention to

copyright, again indicating that now is the right time for research in this area.

### METHODOLOGY

The methodology used in this study is fuzzy inference logic. The data collection technique is library research, such as books, journals, reports, and search queries. For quantitative indicators, international and local statistical databases were used. But for qualitative indicators, queries and journals related to this topic have been used. Fuzzy logic rules then were developed based on all the data and expert reasoning.

### RESULTS AND DISCUSSION

It should be noted that the absence of much statistical data during the analysis made our work difficult, and many factors are of a qualitative or fuzzy nature. Based on such indicators, econometric models are not suitable

for determining the dependence of a factor on other parameters. Various mathematical methods are used to work with qualitative or fuzzy indicators. The method of fuzzy inference systems (FIS) is one of them (Zadeh, 1976; Tsekouras, 2016; Hudec, 2016; Bělohlávek et al., 2017; Shankar & Silva, 1995; Zadeh et al., 1992; Shafizade et al., 2010; Shikhlinakaya & Shafizadeh, 2015; Radhi, 2020; Blahun et al., 2020; Zanon et al., 2020; Hernandez-Aguila et al., 2021; Čičak & Vašíček, 2019; Malyarets et al., 2019). This system was proposed in 1975 by Ebrahim Mamdani, and the method allows you to determine the dependence using both quantitative and qualitative indicators, as well as fuzzy indicators. Therefore, in our study, we use the method of fuzzy inference systems. In the analysis, we have used data that is publicly available to the State Statistics Committee and is shown in the table below.

**Table 1. Statistical data of Azerbaijan in the 2010–2020 years**

Years	The number of Internet users per 100 people	Internet communication (1000 USD)	Average tariff for 20 hours of internet use per month, in USD
2005	8	8443,3	5,5
2006	10	14217,2	5,5
2007	11	14363,5	4,7
2008	17	29612,7	2,7
2009	27	44831,4	2,5
2010	46	51678,1	2,4
2011	65	78570,9	1,9
2012	70	109969,4	1,8
2013	73	125469,7	1,6
2014	75	141361,5	1,6
2015	77	72151,9	0,8
2016	78	67379,6	0,7
2017	79	78049,5	0,7
2018	80	85477,3	0,7
2019	81	92407,5	0,5
2020	85	117161,3	0,5
2021	87	146503,6	0,5

**Source:** [https://www.stat.gov.az/source/information\\_society/](https://www.stat.gov.az/source/information_society/) (2022)

We have applied the fuzzy inference logic method for defining the revenue of the person producing the digital educational product

(Shafizade et al., 2010; Shikhlinakaya & Shafizadeh, 2015; Leonenkov, 2003; Radhi, 2020; Blahun et al., 2020; Zanon et al., 2020;

Hernandez-Aguila et al., 2021; Čičak & Vašiček, 2019; Malyarets et al., 2019).

Functional blocks of fuzzy inference systems (FIS) (Zadeh, 1976; Tsekouras, 2016; Hudec, 2016; Shafizade et al., 2010; Shikhlinaskaya & Shafizadeh, 2015) are:

- Rule Base: contains fuzzy IF-THEN rules.
- Database: defines the membership functions of fuzzy sets used in fuzzy rules.
- The decision-making block: performs an operation on the rules.
- Fuzzification Interface Block: converts crisp quantities into fuzzy
- Defuzzification Interface block: converts fuzzy quantities into crisp quantities.

Steps for computing the output by the method FIS are as follows (Zadeh, 1976; Tsekouras, 2016; Hudec, 2016):

- Step 1: Determining a set of fuzzy rules;
- Step 2: Fuzzifying the inputs using the input membership functions;
- Step 3: Combining the fuzzy inputs according to the fuzzy rules to establish a rule strength;
- Step 4: Finding the consequence of the rule by combining the rule strength and the output membership function;
- Step 5: Combining the consequences to get an output distribution;
- Step 6: Defuzzifying the output distribution (this step is only needed if a crisp output (class) is needed).

### Model application

First, we defined output and input linguistic variables. Linguistic variables are revenues of the person producing the digital educational product; the number of Internet users per 100 people; the average tariff for 20 hours of internet use per month; Internet communication; costs; the ease of finding a digital product during searching; the availability of new information in a digital educational product; the image of the product owner; and utility for the buyer. Input variables are:

- the number of Internet users per 100 people;

- average tariff for 20 hours of internet use per month;
- internet communication;
- costs;
- easy to find digital product during searching;
- the availability of new information in a digital educational product;
- image of the product owner;
- utility for the buyer.

The output variable is:

- revenues of the person producing the digital educational product.
- We denote these linguistic variables as:
- Revenue of the person producing the digital educational product-  $y$ ;
- The number of internet users per 100 people-  $x_1$ ;
- Average tariff for 20 hours of internet use per month-  $x_2$ ;
- Internet communication -  $x_3$ ;
- Costs- $x_4$ ;
- Easiness of finding digital product during searching -  $x_5$ ;
- The availability of new information in a digital educational product- $x_6$ ;
- Image of the product owner- $x_7$ ;
- Utility for the buyer- $x_8$ .

Table 2 shows the term sets (as bad, middle, and good) for these variables.

The interval values of these variables and corresponding term sets are given in Table 3. For defining interval values, revenue and costs of the person producing the digital educational product were used as questionnaires. 500 people participated in the survey. Based on the answers in the questionnaire, it has been determined that the revenues and costs of the person producing the digital educational product are in the range of 100–1000 USD and 15–150 USD, respectively. The minimum and maximum values of input variables  $x_1$  (The number of Internet users per 100 people),  $x_2$  (Average tariff for 20 hours of internet use per month),  $x_3$  (Internet communication) were defined on the basis of Table 1.

**Table 2.** Term sets of input and output linguistic variables

Linguistic variables	Variables	Term sets		
<b>Output variables</b>				
Revenue of the person producing the digital educational product, in USD	<b>Y</b>	<b>bad</b>	<b>middle</b>	<b>good</b>
<b>input variables</b>				
The number of Internet users per 100 people	$x_1$	bad	middle	good
Average tariff for 20 hours of internet use per month, in USD	$x_2$	bad	middle	good
Internet communication (1000 USD)	$x_3$	bad	middle	good
Costs, USD dollar	$x_4$	low	middle	more
The ease of finding digital product during searching	$x_5$	bad	middle	good
The availability of new information in a digital educational product	$x_6$	bad	middle	good
Image of the product owner	$x_7$	bad	middle	good
Utility for the buyer	$x_8$	bad	middle	good

Source: The term sets of input and output linguistic variables have been defined by the authors in accordance with the requirements of the fuzzy logic method in the MATLAB program.

The interval values of these variables and corresponding term sets are given in Table 3. For defining interval values, revenue and costs of the person producing the digital educational product were used as questionnaires. 500 people participated in the survey. Based on the answers in the questionnaire, it has been determined that the revenues and costs of the person producing the digital educational product are in the range of 100–1000 USD and 15–150 USD, respectively. The minimum and maximum values of input variables  $x_1$  (The number of Internet users per 100 people),  $x_2$  (Average tariff for 20 hours of

internet use per month),  $x_3$  (Internet communication) were defined on the basis of Table 1.

The input variables  $x_5$  (the ease of finding a digital product during searching),  $x_6$  (the availability of new information in a digital educational product) and  $x_7$  (image of the product owner),  $x_8$  (utility for the buyer) are quality parameters. The interval values of these variables were estimated on the base expert assessment as (0-10) (Zadeh et al., 1992, pp. 263-281; Zanon et al., 2020, p. 21).

**Table 3.** Interval values of input and output variables corresponding to their term sets

Variables	Term sets		
	bad	middle	good
Output variables			
Y (100-1000)	(100-300)	(300-600)	(600-1000)
Input variables			
$x_1$	(0-30)	(30-60)	(60-100)
$x_2$	(0,5 -2,2)	(2,2-3,9)	(3,9-5,5)
$x_3$	(8443,3-52749,4)	(52749,4-97055,5)	(97055,5-146503,7)
$x_4$	(15-60)	(60-105)	(105-150)
$x_5$	(0-3)	(3-6)	(6-10)
$x_6$	(0-3)	(3-6)	(6-10)
$x_7$	(0-3)	(3-6)	(6-10)
$x_8$	(0-3)	(3-6)	(6-10)

Source: The interval values of the input and output variables, respectively, and their term sets are

determined by the authors in accordance with the requirements of the fuzzy logic method in the MATLAB program.

The model then is implemented with fuzzy sets fuzzification. The membership function for these fuzzy sets is constructed as a Gaussian function.

The next step is to construct logical rules on the basis of expert reasoning. For example, expert reasoning can be written in the following form:

- If (the number of Internet users per 100 people is bad) and (the average tariff for 20 hours of internet use per month is middle) and (Internet communication is middle) and (costs are middle) and (easiness of finding digital products during searching is middle) and (the availability of new information in a digital educational product is middle) and (the image of the product owner is middle) and (utility for the buyer is middle), then (revenue of the person producing the digital educational product is middle);
- If (the number of Internet users per 100 people is bad) and (the average tariff for 20 hours of internet use per month is bad) and (Internet communication is middle) and (costs are middle) and (easiness of finding digital products during searching is middle) and (the availability of new information in a digital educational product is middle) and (the image of the product owner is middle) and (utility for the buyer is middle), then (revenue of the person producing the digital educational product is middle);
- If (the number of Internet users per 100 people is bad) and (the average tariff for 20 hours of internet use per month is bad) and (Internet communication is bad) and (costs are middle) and (easiness of finding digital products during searching is middle) and (the availability of new information in a digital educational product is middle) and (the image of the product owner is middle) and (utility for the buyer is middle), then (revenue of the person producing the digital educational product is bad);
- If (the number of Internet users per 100 people is bad) and (the average tariff for 20 hours of internet use per month is bad) and (Internet communication is bad) and (costs are low) and (easiness of finding digital products during searching is middle) and (the availability of new information in a digital educational product is middle) and (the image of the product owner is middle) and (utility for the buyer is middle), then (revenue of the person producing the digital educational product is middle);
- If (the number of Internet users per 100 people is bad) and (the average tariff for 20 hours of internet use per month is bad) and (Internet communication is bad) and (costs are low) and (easiness of finding digital products during searching is bad) and (the availability of new information in a digital educational product is middle) and (the image of the product owner is middle) and (utility for the buyer is middle), then (revenue of the person producing the digital educational product is bad);
- If (the number of Internet users per 100 people is bad) and (the average tariff for 20 hours of internet use per month is bad) and (Internet communication is bad) and (costs are low) and (easiness of finding digital products during searching is bad) and (the availability of new information in a digital educational product is bad) and (the image of the product owner is middle) and (utility for the buyer is middle), then (revenue of the person producing the digital educational product is bad);
- If (the number of Internet users per 100 people is bad) and (the average tariff for 20 hours of internet use per month is bad) and (Internet communication is bad) and (costs are low) and (easiness of finding digital products during searching is bad) and (the availability of new information in a digital educational product is bad) and (the image of the product owner is bad) and (utility for the buyer is middle), then (revenue of the person producing the digital educational product is bad);
- If (the number of Internet users per 100 people is bad) and (the average tariff for 20 hours of internet use per month is bad) and (Internet communication is bad) and (costs are low) and (easiness of finding digital products during searching is bad) and (the availability of new information in a digital educational product is bad) and (the image of the product owner is middle) and (utility for the buyer is middle), then (revenue of the person producing the digital educational product is bad);



the product owner is bad) and (utility for the buyer is bad), then (revenue of the person producing the digital educational product is bad);

- If (the number of Internet users per 100 people is bad) and (the average tariff for 20 hours of internet use per month is good) and (Internet communication is good) and (costs are more) and (easiness of finding digital products during searching is good) and (the availability of new information in a digital educational product is good) and (the image of the product owner is good) and (utility for the buyer is good), then (revenue of the person producing the digital educational product is good);
- If (the number of Internet users per 100 people is bad) and (the average tariff for 20 hours of internet use per month is bad) and (Internet communication is good) and (costs are more) and (easiness of finding digital products during searching is good) and (the availability of new information in a digital educational product is good) and (the image of the product owner is good) and (utility for the buyer is good), then (revenue of the person producing the digital educational product is good);
- If (the number of Internet users per 100 people is bad) and (the average tariff for 20 hours of internet use per month is bad) and (Internet communication is bad) and (costs are more) and (easiness of finding digital products during searching is good) and (the availability of new information in a digital educational product is good) and (the image of the product owner is good) and (utility for the buyer is good), then (revenue of the person producing the digital educational product is middle);
- If (the number of Internet users per 100 people is bad) and (the average tariff for 20 hours of internet use per month is bad) and (Internet communication is bad) and (costs are low) and (easiness of finding digital products during searching is good) and (the availability of new information in a digital educational product is good) and (the image of the product owner is good) and (utility for the buyer is good), then (revenue of the person producing the digital educational product is bad) and etc.

Then fuzzy inference logic rules will be in the following form:

- If (x1 is bad) and (x2 is middle) and (x3 is middle) and (x4 is middle) and (x5 is middle) and (x6 is middle) and (x7 is middle) and (x8 is middle), then (y is middle);
- If (x1 is bad) and (x2 is bad) and (x3 is middle) and (x4 is middle) and (x5 is middle) and (x6 is middle) and (x7 is middle) and (x8 is middle), then (y is middle);
- If (x1 is bad) and (x2 is bad) and (x3 is bad) and (x4 is middle) and (x5 is middle) and (x6 is middle) and (x7 is middle) and (x8 is middle), then (y is bad);
- If (x1 is bad) and (x2 is bad) and (x3 is bad) and (x4 is low) and (x5 is middle) and (x6 is middle) and (x7 is middle) and (x8 is middle), then (y is bad);
- If (x1 is bad) and (x2 is bad) and (x3 is bad) and (x4 is low) and (x5 is bad) and (x6 is middle) and (x7 is middle) and (x8 is middle), then (y is bad);
- If (x1 is bad) and (x2 is bad) and (x3 is bad) and (x4 is low) and (x5 is bad) and (x6 is bad) and (x7 is middle) and (x8 is middle), then (y is bad);
- If (x1 is bad) and (x2 is bad) and (x3 is bad) and (x4 is low) and (x5 is bad) and (x6 is bad) and (x7 is bad) and (x8 is middle), then (y is bad);
- If (x1 is bad) and (x2 is bad) and (x3 is bad) and (x4 is low) and (x5 is bad) and (x6 is bad) and (x7 is bad) and (x8 is bad), then (y is bad);
- If (x1 is bad) and (x2 is good) and (x3 is good) and (x4 is more) and (x5 is good) and (x6 is good) and (x7 is good) and (x8 is good), then (y is good);
- If (x1 is bad) and (x2 is bad) and (x3 is good) and (x4 is more) and (x5 is good) and (x6 is good) and (x7 is good) and (x8 is good), then (y is good);
- If (x1 is bad) and (x2 is bad) and (x3 is bad) and (x4 is more) and (x5 is good) and (x6 is good) and (x7 is good) and (x8 is good), then (y is middle);
- If (x1 is bad) and (x2 is bad) and (x3 is bad) and (x4 is low) and (x5 is good) and (x6 is good) and (x7 is good) and (x8 is good), then (y is bad) and etc.

## RESULTS

The rules have been constructed with the support of linguistic variables for the revenue of the person producing the digital educational product. Transforming the above rules will get fuzzy sets for the output variable  $y$  on the basis of each rule. The composition method gives a fuzzy set, which is the range of values of fuzzy output variables, and by using the centroid method we have obtained a crisp numerical solution.

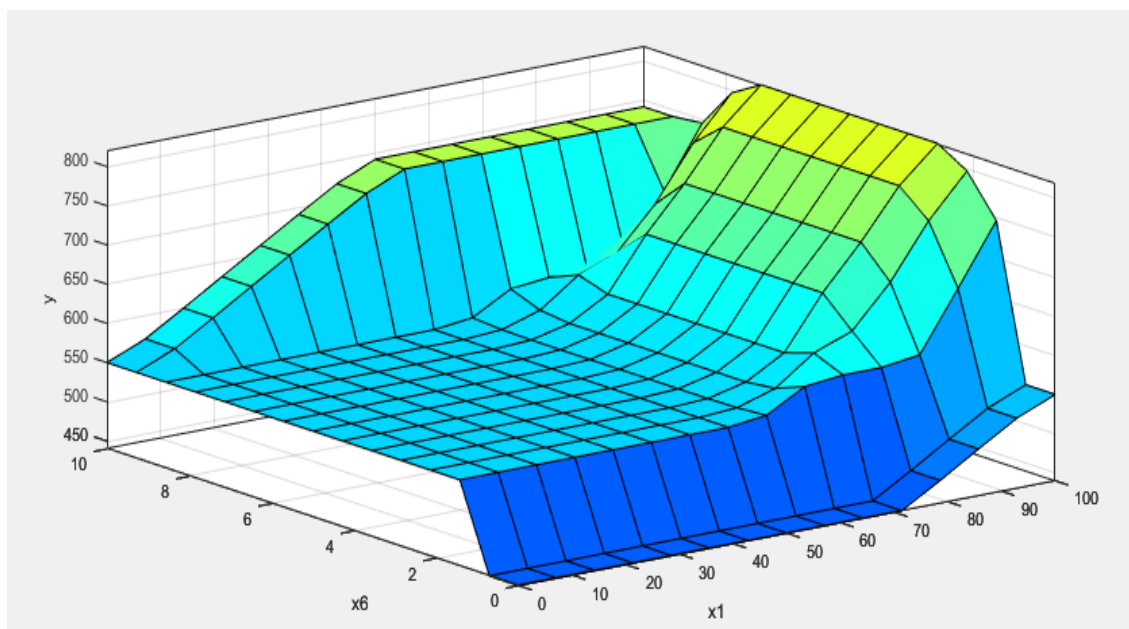
The fuzzy inference logic method was realized by the MATLAB Software Package (Leonkov,

2003).

As the solution to this problem for each linguistic variable, we have obtained the following crisp values:

If  $x_1=50$  and  $x_2=3,04$  USD dollars and  $x_3=74,9$  (\*1000 USD) and  $x_4 =82,5$  USD and  $x_5 =5$  and  $x_6 =5$  and  $x_7 =5$  and  $x_8 =5$  then  $y = 550$  USD.

The dependence of  $y$  (revenue of the person producing the digital educational product) on  $x_1$  (the number of Internet users per 100 people) and  $x_5$  (the ease of finding digital products during searching) is shown in Figure 1.



**Fig.1.** Dependence of  $y$  (revenue of the person producing the digital educational product) on  $x_1$  (the number of Internet users per 100 people) and  $x_5$  (the ease of finding digital products during searching)

Source: Figure 1 has been obtained as a result of the analysis conducted by the authors based on the application of the fuzzy logic method in the MATLAB program.

If the number of Internet users per 100 people is 50, the average tariff for 20 hours of internet use per month is 3.039 USD, internet communication is 74900 USD (74.9 (\*1000 USD), costs are 82.5 USD, the ease of finding digital products during searching is 5 (middle), the availability of new information in a digital educational product is 5 (middle), the image of the product owner is 5 (middle), the utility for the buyer is 5 (middle), and the revenue of the person producing the digital educational product is 550 USD.

As a result of our research, we can answer our

questions in the following way:

1. The possibility of providing digital educational products directly depends on the number of Internet users. Increasing the quality of the Internet connection and ensuring an average tariff for using the Internet per month in the amount of 3–4 US dollars will provide a good increase in income from sales of digital educational products.

2. According to the results of the study, it can be seen that both qualitative and quantitative indicators considered by us have an average impact on the growth of income from sales of digital educational products. At the same time, if the quantitative indicators are average and the qualitative indicators improve, then this will generate a greater increase in income to the authors of digital educational products.

### CONCLUSIONS

While we have taken into account existing open-source licenses and a lot of research on their protection, we believe that a compromise is needed to strike a balance between the interests underlying the protection of intellectual property rights (Rooksby, Hayter, 2019; Gordon, Superfine, 2020) and the requirements of the digital society.

It is likely that the conflict of interest (between the manufacturer, who wants to generate income, and the public, who wants more open licenses for digital educational products) needs to be considered by authors and intermediaries providing digital educational products.

We also have taken into account that the policy of generating income from the sale of digital educational products may have a number of disadvantages:

Since the price is determined by the author, a certain product at a high price will be concentrated in the hands of a few people and distribution among the population may be reduced; therefore, the costs of these goods will be high.

Due to high prices, the gap between consumers may increase; not everyone will be able to afford it.

Generating income from the sale of digital educational products, however, can bring more benefits:

- Authors will have an incentive to create new digital educational products;
- Profit opportunities can help scale up, bringing new products into the hands of consumers;
- The quality of digital educational products can grow, and this will serve as the basis for

the development of digital educational products;

- The possibility of making a profit can lead to a faster transition from paper to digital, which will affect the development of the digital economy, the knowledge economy, and sustainable development.

We have determined that such qualitative indicators as the ease of finding a digital product when searching, the presence of new information in a digital educational product, the image of the product owner, and the usefulness of a digital educational product for the buyer have the same average impact on increasing the income of authors. It is necessary to study how income from digital educational products is influenced by factors related to their cost, quality, and manufacturability. This is necessary to create better educational products and determine the authors' motivation system.

Therefore, we believe that due to the growth of the digital education market, the study of the relationship between the sale of digital educational products and the income of authors should be continued.

Our discussion has promising directions for future research in the fields of intellectual property and educational products. We return to additional proposals for a future research program.

It is necessary to study how income from digital educational products is influenced by factors related to their cost, quality, and manufacturability. This is necessary to create better educational products and determine the authors' motivation system.

Therefore, we believe that due to the growth of the digital education market, the study of the relationship between the sale of digital educational products and the income of authors should be continued.

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### ABOUT THE AUTHORS

Sugra Humatova, (corresponding author)

email: [sugra\\_humatova@unec.edu.az](mailto:sugra_humatova@unec.edu.az)

**Afag Huseyn is an Associate Professor in the**

Department of Business Administration,  
UNEC Business School, Azerbaijan State  
University of Economics (UNEC).

**Elnura Shafizade, Ph.D.,** Department of Business  
Administration, UNEC Business School,  
Azerbaijan State University of Economics  
(UNEC).

**Sugra Humatova, is an Associate Professor,**  
Head of Department of Economics,  
Azerbaijan State University of Economics  
(UNEC).

**Tahmasib Huseynov, Ph.D.,** International Center  
for Graduate Education, Azerbaijan State  
University of Economics (UNEC).