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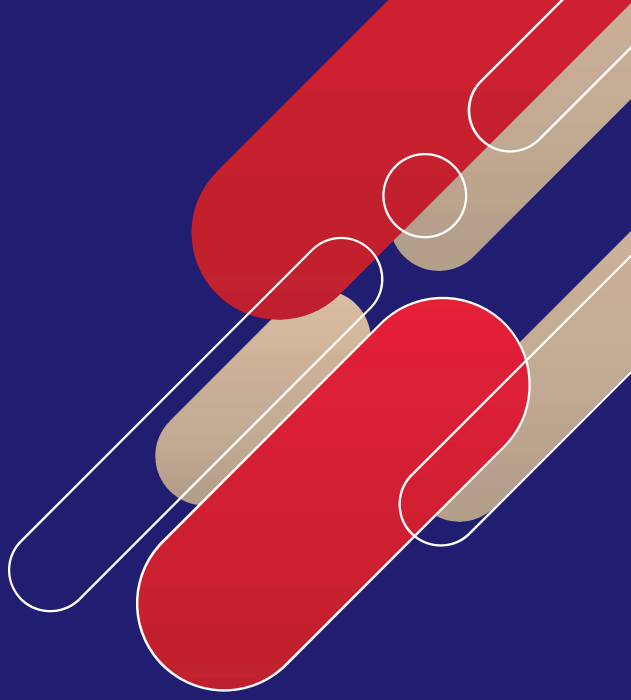

British Council Report

Mapping the Game Development Industry in Macedonia

Skopje, March 2022

www.britishcouncil.mk

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1. Introduction

The cultural and creative industries are of increasing significance in Macedonia, as in many other countries around the world. In the Macedonian context, this has been particularly true of the games and game development industries, driven by a combination of skilled and ambitious developers and an enthusiastic young audience of gamers. As positive as this trend is, it has been hampered by a combination of inadequate data, patchy education and skills provision and the inevitable problems of scale and investment in a country with a relatively small population and a correspondingly small domestic market.

To help address some of these concerns, the British Council office in Skopje has initiated this evidence-based research, mapping the game development industry in Macedonia so as to better understand the sector and offer concrete policy solutions. The analysis and mapping report has been undertaken and written by a research team from the Institute for Sociological, Political, and Juridical Research, University Ss. Cyril and Methodius in Skopje, in collaboration with MAGDA and MASIT.

Although such a comprehensive analysis of the game development industry at an institutional or strategic level has never been done before in Macedonia, it builds on a decade of reports, initiatives and industry practice.

In 2009, the Ministry of Culture made a step forward and, in cooperation with the British Council, published the first mapping document for the creative and cultural industries in Macedonia (Mapping of the Creative Industries in the Republic of Macedonia. Skopje: Ministry of Culture of the Republic of Macedonia, 2009). This document provided proposals for further action, but lacked economic data (Microsoft Word - Kniga KI konecna verzija Angliski.doc (britishcouncil.mk).

In 2015-16, the Ministry of Culture appointed a national working group on creative industries to develop a methodology for mapping creative industries in Macedonia, Guidelines for mapping Macedonia's creative industries | British Council.

The recent Peer Review by the Council of Europe (CoE, December 2020), entitled: 'Cultural Policy Review of the Republic of N. Macedonia – Towards a Strategy for Heritage and the Development of Culture and Creative Industries: https://keanet.eu/wp-content/uploads/Final-report-MK-0902.docx.pdf was compiled with the aim of considering policy options for better coordination between the Ministry of Culture's objectives for supporting the country's cultural heritage and its cultural and creative sector. The CoE document also provided priority recommendations to the Ministry of Culture.

There still remains a significant lack of data about the current state and potential of the creative and cultural industries in the country. One of the most substantial research projects that took place in 2009 is 'Mapping of Creative Industries in Macedonia', mentioned above, which focused on 21 selected creative industries, but it is now outdated and it lacks economic indicators, and it does not include the IT sector.

All other relevant research has been done by external bodies that have included Macedonia as part of wider international reports and research, for example 'CREATIVE ECONOMY OUTLOOK - Trends in International Trade in Creative Industries', published by the United Nations in 2018, that examined import and export trends in the creative industries. The 2019 IT.mk report 'Mapping the IT Industry in .mk 2019 * IT.mk' covered mapping, but only in terms of the IT industry. Since game development was not seen as part of the overall IT and software industry, such mapping exercises failed to capture data and mapping for the games sector.

However, the Macedonian Game Developers Association (MAGDA) has identified a number of problems the gaming community needs to address and, for 10 years, it has been successfully organizing the Macedonian national edition of Global Game Jam (https://gamejam.mk/). One of the founders of MAGDA and contributor to this mapping, Daniela Spasovska, wrote a master thesis "Entrepreneurship in Creative Industries: How can Macedonia Score High in the World Creative Economy" (defended in Novi Sad, 2013), which was the first effort for data collection regarding the Macedonian game development industry.

Creative and cultural industries (CCI) are included in the Ministry of Culture document entitled 'National Strategy for Cultural Development' for the period 2018-2022, (Nacionalna strategija 2018_2022.pdf - Google Drive), which considers a range of relevant issues, including:

- Creating conditions for local development of creative industries as a contribution to the economic development of municipalities through financial support for cooperation with the local business sector, especially for the promotion of cultural tourism the cultural industries and crafts, as well as the independent cultural scene;
- tourism development and sustainability;

The main guidelines in this section on CCI, among other things, include:

- Mapping the available and potential resources for cultural and creative industries at a national, local and urban level by analyzing the existing infrastructure, identifying problems, positive capacities and development trends, as well as giving directions for future development;
- Creating favourable conditions for cooperation and development of the cultural and creative industries through appropriate sectorial policies, including regional and local strategies, local development plans and national strategic documents;
- Utilization of local resources and infrastructure to improve the local economy through a link between creativity and the economy;
- Greater financial incentives for the cultural and creative industries;
- Encouraging research activities, innovation, creativity and entrepreneurship in the creative and cultural industries.

2. Research Methodology

In order to gain as much information as possible about the game development industry in the country, especially as this mapping report represents a preliminary and descriptive baseline research study, a mixed-method research design was adopted and applied.

Accordingly, several different data sources and target populations were investigated, and several research phases, methods and procedures were used, in line with the recommendations comprised in the GUIDELINES FOR MAPPING MACEDONIA'S CREATIVE INDUSTRIES (British Council, 2016) and the CREATIVE INDUSTRIES ECONOMIC ESTIMATES METHODOLOGY (Department for Culture, Media and Sport, 2016):

- Secondary data analysis/content analysis of relevant and existing national and inter-

national documents (research/mapping reports, organizational documentation, laws, strategies, policies);

- Quantitative analysis of selected secondary data/statistical indicators available and collected via free access to public information and on request, from relevant national institutions in the country such as the State Statistical Office and the Central Registry;
- Desk research: analysis of the official websites/social media profiles of the Macedonian game development studios/independent developers/games and educational providers in the country (formal and non-formal education);
- Primary data analysis: qualitative analysis of data gained through online semi-structured interviews with the key stakeholders in the game development industry in Macedonia. The interview guides were developed by the research consultants, converted into Google forms, and distributed by MAGDA. The following were considered as key stakeholders/research target populations: game developers: MAGDA representatives, employees at game development companies/studios and freelancers - with a total of N=26 conducted interviews, and game development companies/studios representatives: owners/managers - with N=10 of conducted interviews.

3. About the Game Development Industry in General

The video games industry dates back to 1952, when the first digitized version of Tic Tac Toe, named OXO, was released by a professor at the University of Cambridge (The Gaming Industry During COVID-19 – Business Review at Berkeley).

The game development industry (gamedev) includes the design, development, production, and publishing of games. It creates jobs for game developers, designers, artists, and people involved in marketing and sales, etc. The gaming industry has a much broader meaning, encompassing game development and production, together with tools and equipment for gamers and, more recently, e-sports.

The Video Games market is the biggest market within Digital Media. The number of users, globally, is expected to rise to 3,197.7m users by 2026.

Newzoo (2020) estimated that in 2020 the global value of the games market would reach USD 159.3 billion, which is an increase of over 9% compared to the previous year, with USD 77.2 billion generated by mobile, USD 45.2 billion by console, and the remaining USD 36.9 billion by PC games.

Within the next couple of years, the gaming market is expected to develop at a comparable rate, reaching USD 200 billion in 2023, at an average growth rate of 8.3% year-on-year. The growth of the console game market is likely to accelerate because of the launch of next generation consoles, but it is unlikely to reach a double-digit rate.

The pandemic has had slight negative impacts on the mobile segment, but it is still on track to grow +4,4% yearly. As a consequence of the stay-home restrictions during the pandemic, people craved social interaction, and many turned to gaming as a way to engage with friends and

family. It created a new generation of gamers and it has given the tech-engrossed millennials another excuse to be glued to screens throughout the day (https://businessreview.berkeley.edu/the-gaming-industry-during-covid-19/). A significant percentage of them will probably be retained.

According to Statista (2021), in Macedonia the average revenue per user (ARPU) in the Video Games segment is projected to amount to US$28.77 in 2022. In the Video Games segment, the number of users is expected to amount to 0.7m users by 2026. User penetration will be 30.1% in 2022 and it is expected to hit 32.3% by 2026.

Video games represent one of Europe's most compelling economic success stories, and a rapidly growing segment of its creative industries. The European video game industry is worth €23.3bn, according to the Europe's video games industry - ISFE.

According to the EGDF report (2021), in 2019, Europe was home to 4,913 game developer studios and 203 game publishers.

4. The Structure of the Macedonian Gaming Environment

There are three elements of the Macedonian gaming environment: (1) game development (2) gaming as a consumer industry and (3) e-sports. This mapping report focuses on the game development industry and, therefore, the Macedonian Game Developers Association (MAGDA) is a collaborator in this project and a key stakeholder in the report. MAGDA is an association which unites the Macedonian gaming community and, for 10 years, it has been successfully organizing the national edition of the Global Game Jam (https://gamejam.mk/). But it should also be noted that there are two other relevant trade organizations: the Macedonian eSsport Association (MESA), MESA – Macedonian eSports Association and the Macedonian eSsport Federation (MESF), Македонска Еспорт Федерација (mesf.mk). MESA is an organization which works hard on developing the e-sports in Macedonia and MESF organizes national e-sports leagues and qualification tournaments for world and European championships.

5. Macroeconomic Indicators for Macedonia (Standard Industrial Classifications (SIC) and Standard Occupational Classifications (SOC) Analysis)

The emerging sectors are hard to analyze using SIC codes – as the data below demonstrates. The closest SIC code for game developers is 'Publishing Computers Games' (58.21) which appears under 'Software Publishing' (58.2) in the Industry Sector "Information and Communication". This code (58.21) was introduced into the official statistics in 2008.

In our research, seven of the ten companies/studios which participated reported that they are registered under the SIC code 62.02 – 'Computer programming', while one studio is registered under 62.09 – 'Other services related to information technology and computers', one under 92.11 – 'Production (film/TV)', and only one studio is registered under 58.21 – 'Publishing Computer Games'.

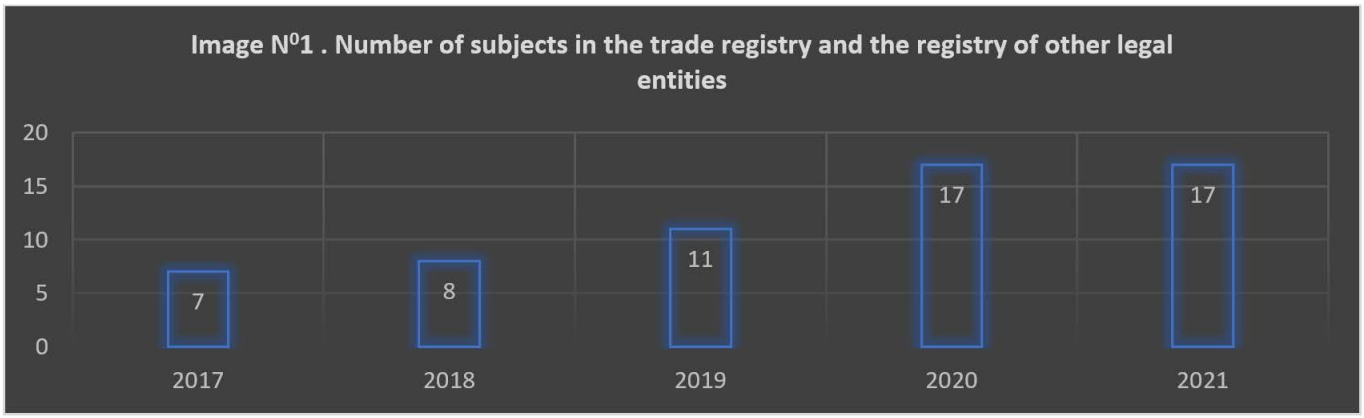
We can, therefore, conclude that the gaming sector is poorly captured by the existing SIC codes and it is hard to identify accurate data from official data sources. Companies have few incentives to select the right SIC code (though the State Statistical Office provides some quality assurance of SIC codes in producing its industry statistics). Moreover, innovative companies that straddle multiple sectors struggle to choose their SIC code. After merging the secondary data and the qualitative data from our working group, we came to the realization that 'Game Development Industry' covers other SIC codes from other industries. The business activities and related sectors covered by the SIC code for 'Game Development Industry' are presented in the table below. They are divided into two parts (primary and secondary) according to the Value Chain Model which identifies primary and secondary activities of the process.

Table 1. Industries related to GD –SIC codes

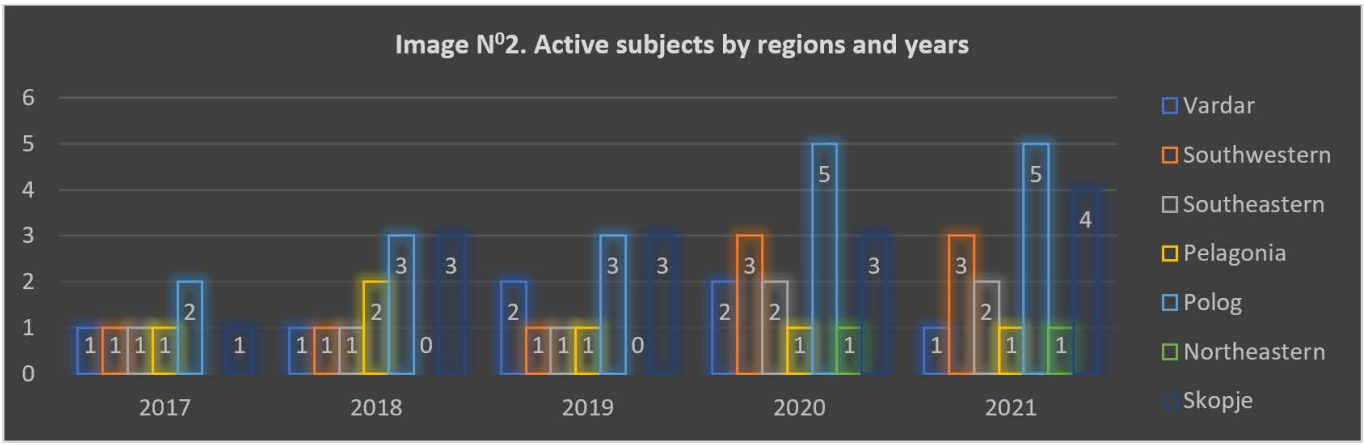
Economic activities/ Industry	SIC 2008	Description
Primary activities		
IT, software, and computer services	58.21	Publishing Computer Games for all Platforms
	62.01	Computer programming
Film, TV, video, radio and photography Music, performing and visual arts	59.12	Computer graphics, animation and special effects, film development and processing, as well as activities of film laboratories and special laboratories for animated films
	59.20	Recording sound recordings and publishing music recordings
Secondary activities		
Business administration and marketing	70.21	Public relations and communication Activities
	73.11	Advertising agencies
	73.12	Media representation
	70.22	Business and other management consulting activities
	69.10	Legal matters
	69.20	Accounting, bookkeeping and auditing; tax advice

The following data on the 4-digit SIC code 58.21. - PUBLISHING COMPUTER GAMES were collected via the official website/statistical bulletin of the Central Registry[1] and analyzed/interpreted by the research team.

[1] Statistical bulletin (crm.com.mk)



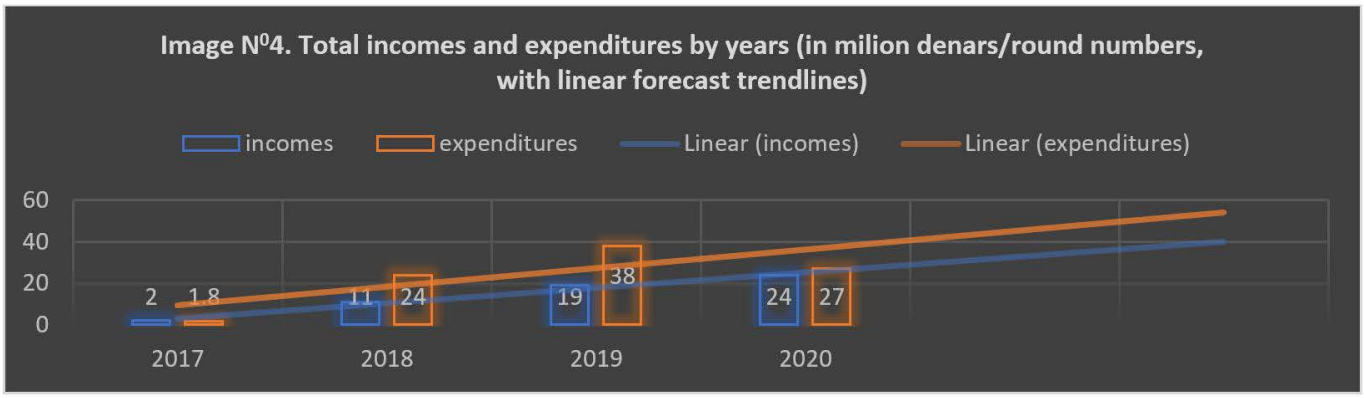
In the last two years, the number of registered/existing companies[2] in the sector of publishing computer games is seventeen. Although the number is low overall, the data shows a positive trend over the 5-year period.



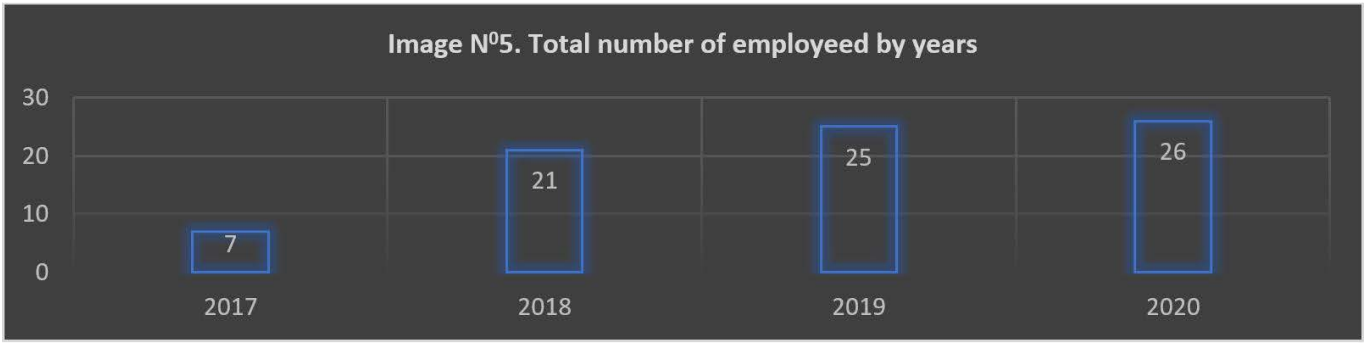
Polog with five companies, Skopje with four in 2021 and three in 2020, and the Southwestern Region with three companies, are among the regions with the highest number of the active businesses in the last two years. It should be noted that there were no businesses recoded in the Eastern Region over the analyzed 5-year period.

According to the data analysis, there is a positive trend and forecast related to the number of newly registered and closed companies for this sector. Or, more precisely, there were nineteen newly registered companies, and eight that ceased trading over the analyzed 5-year period. We have not had an opportunity to investigate the reasons for the closures.

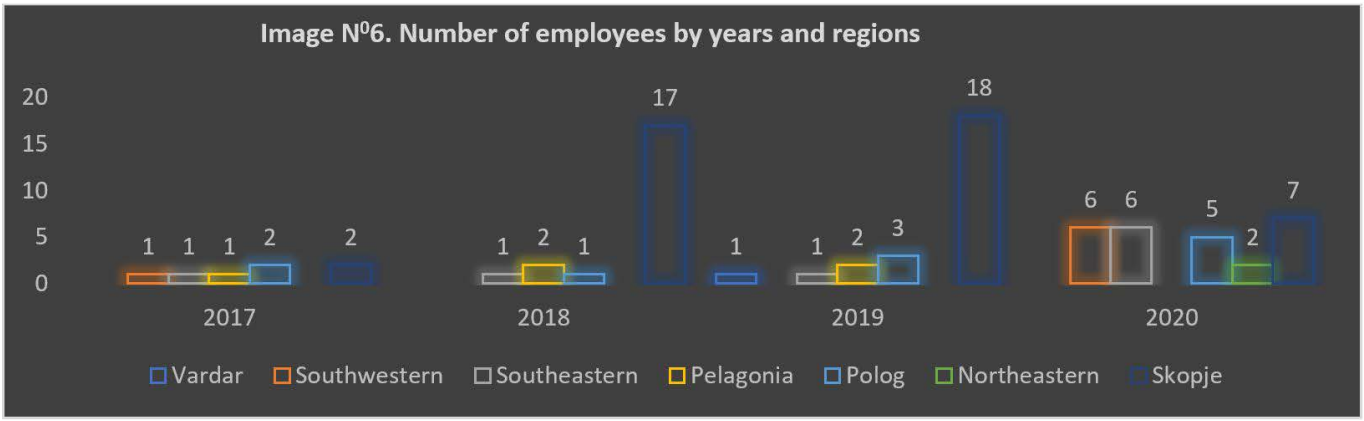
[2] Notice: All (100%) analyzed subjects are registered under code 05.0 or as private companies.



The data analysis shows that the Macedonian companies in the sector of publishing computer games were in an overall deficit with their outgoings (from 1,8 million denars in 2017, 24 million denars in 2018, 38 million denars in 2019, and 27 million denars in 2020) being higher than their incomes (2 million denars in 2017, 11 million denars in 2018, 19 million denars in 2019, and 24 million denars in 2020). The reasons for this outcome are additionally investigated with the qualitative analysis in the report.



The latest year for which data on numbers of employees in this sector is available is 2020, when there were 26 employees, an increase from 2019 (25 employees), 2018 (21) and a significant increase from 2017 with only 7 employees. Nevertheless, all these numbers are very low.



The employees in this sector are predominantly from the Skopje region.

The second step was to detect the occupations from different industries that are close and important for the game development industry. The table below shows the occupations that can be part of this industry according to the official statistic codes, last changed in 2015.

Table 2. Game Developer occupations by industry and occupations

Occupations group	SIC 2008	SOC 2015	Description
Primary activities			
IT, software and computer services	62.01 58.21		
		2512	Software developers (developer)
		2514	Application developers
		2521	Database designers and administrators
		2522	System administrators
		2523	Computer networking experts
Performers for film, TV, video, radio and photography	59.12 59.20	2166	Graphic and multimedia designers
		2651	Visual artists (2D and 3D artists, concept art)
		2652	Musicians, singers and composers
		2654	Film and stage directors, producers and related occupations
		2655	Actors
Secondary activities			
Business administration and marketing	70.21 73.11 73.12 70.22 69.10 69.20	1221	Marketing and sales directors
		1222	Advertising and public relations directors
		2432	Public relations professionals
		1330.	Directors of information and communication technology companies
		2411	Accountants
		2412.	Financial and investment advisors
		2413.	Financial analysts
		2421.	Management and organization analysts
		2422.	Legal administration experts
		2423	HRM experts
		2424.	Specialists for training and HR development

5.1. Defining Creative Occupations

The NESTA (2013) definition of 'creative occupation' is:

"These creative skills involve a combination of original thought – all creative skills involving problem solving to a greater or lesser degree – with processes defined by collaborative relationships to deliver or realize the output." The creativity consists in devising an original way of

meeting a differentiated need or requirement that is not expressed in precise terms.

We adopted the Creative Grid approach in identifying creative occupations, with our findings summarized in the table below. On this basis, any occupation with a creativity score of four or five was included as a 'creative occupation'.

Table 3. Creative occupations SOC code according to the Creative Grid measurement

SOC 2015	Description	Novel process	Mechanization resistant	Non-repetitiveness or non-uniform function	Creative contribution to the value chain	Interpretation, not mere transformation	Total
2166	**Graphic and multimedia designers**	1	1	0	1	1	4
2512.	**Software developers**	1	1	0	1	1	4
2514	**Application developers**	1	1	0	1	1	4
2521	**Database designers and administrators**	1	1	1	1	1	5
2523.	**Computer networking experts**	1	1	1	0	1	4
2651	**Visual artists**	1	1	0	1	1	4
2652	**Musicians, singers and composers**	1	1	0	1	1	4
2654	**Film and stage directors, producers**	1	1	0	1	1	4
2655	**Actors**	1	1	1	1	1	5
1221	**Marketing and sales Directors**	1	1	0	1	1	4
1222	**Advertising and public relations directors**	1	1	0	1	1	4

According to the Creative Grid methodology, jobs with a creativity score of 3 or less are defined as non-creative, and they are listed in the table below.

Table 4. Non-creative occupations SOC code according to the Creative Grid measurement

2522	System administrators
2432	Public relations professionals
1330.	Directors of information and communication technology companies
2411	Accountants
2412.	Financial and investment advisors
2413.	Financial analysts
2421.	Management and organization analysts
2422.	Legal administration experts
2423	HRM experts
2424.	Specialists for training and HR development

Table 5. Creative industries SIC code and creative occupations SOC code

Creative economy activity	SIC 2008	SOC 2015	Description
Primary activities			
IT, software and computer services			
	62.01 58.21	2512	Software developers (developer)
		2514	Application developers
		2521	Database designers and administrators
		2523	Computer networking experts
Performers for film, TV, video, radio and photography	59.12 59.20	2166	Graphic and multimedia designers
		2651	Visual artists (2D and 3D artists, concept art)
		2652	Musicians, singers, and composers
		2654	Film and stage directors, producers, and related occupations
		2655	Actors
Secondary activities			
Business administration and marketing	70.21 73.11 73.12	1221	Marketing and sales sirectors
		1222	Advertising and public relations directors
		2432	Public relations professionals

5.2. Creative Industries and Creative Intensities

The method that we used in this paper focuses on a measure which Freeman (2004: 7) termed 'creative intensity', defined as the proportion of workers in any given creative industry that are engaged in a creative occupation. The definition of what constitutes a 'creative industry' or sub-sector is calculated by looking at the percentage of individuals in one of the Creative Occupations employed in an industry as defined by its 4-digit SIC code, to give a percentage figure for its 'creative intensity'. To arrive at the 'creative intensity' of a sub-sector, the number of creative jobs in each industry must be divided by the total number of jobs in that industry.

On this basis, and despite matching the available data from the State Statistical Office and the Central Registry, we encountered several difficulties in arriving at a robust calculation of the 'creative intensity':

- National official statistics are limited. There is no available official statistical information on Occupations/Industries (SIC/SOC) on the 4-digit level code. From the State Statistical Office it was only possible to find data on occupations and industries on 3-digit level code (SIC/SOC code). It is important to note that data on occupations/ industries on the 3-digit level codes are not collected at a systematic national level. They are compiled on a sample level and, therefore, they are not representative.
- In the Central Registry, there are some available data on the 4-digit level codes for business entities and their affiliation to industries (SIC), but with limitations because such data only exist for a number of business entities in specific a 4-level code and for employees within these industries. There is no data available on the total number of occupations and their SOC codes within the industries.
- The low level of employment in the targeted industries is a further limitation and the numbers of employees per industry are as follows: SIC: 58.21. Game publishing – 20 employees; 59.12 Computer graphics, animation and special effects, film development and processing, as well as activities of film laboratories and special laboratories for animated film - 28 employees; 59.20 Recording sound recordings and publishing music recordings – 82 employees; 73.12 Media representation - 49 employees; 70.21 Public relations and communication activities - 164 employees; even on a 3-digit level the jobs in the above industries are below 200[3].

For these reasons, we decided to adopt the UK creative intensity measurement for the industries related to game development. On this basis, any job with a creative intensity above 30% is considered as 'creative'.

[3] To arrive at a 'creative intensity' of a sub-sector, the number of creative jobs (SOC10) in each industry has been divided by the total number of jobs in that industry. Industries (SIC07) which have more than 6,000 jobs and a "creative intensity" of more than 30 per cent were considered as candidates for inclusion. Industries on the threshold of either criterion are then considered through consultation. Macedonia may wish to go through a similar exercise, with the threshold for total employment revised down to reflect the smaller population to a figure of around 200 jobs; or it may simply wish to adopt the UK SIC07 industries, at least for the purposes of a mapping study. GUIDELINES FOR MAPPING MACEDONIA'S CREATIVE INDUSTRIES. P. 18.

Table 6. Creative intensities in codes defined by DCMS as creative in the UK (selected)

SIC (UK)	Industry	Intensity
9003	Artistic creation	90%
5912	Motion picture, video, and television programme post-production activities	89%
5911	Motion picture, video, and television programme production activities	68%
7312	Media representation	47%
5920	Sound recording and music publishing activities	40%
7311	Advertising agencies	39%
6201	Computer programming activities	11%

Source: A DYNAMIC MAPPING OF THE UK'S CREATIVE INDUSTRIES. Pg.11. https://www.anewdirection.org.uk/asset/730

5.3. Job Prospects in the Gaming Industry

From the analysis of the on the labour market demand in the game development industry, a selection of emerging jobs has been made for this purpose, presented in the table below.

Table 7. Jobs in the gaming industry

Art	Concept artist 2D 3D Modelling artist Character artist Texture artist Art director
Animation	2D animator 3D animator Technical animator
Technical art	Technical artist Visual effects artist (VFX) Graphics programmer
Audio	Music composer Audio programmer Sound designer Sound Ddrector

Design	Gameplay designer Creative director Game/script writer Lead designer Level designer UI /UX designer
Production	Publisher Producer Sound producer Project manager Marketing executive
Programming	Engine programmer Gameplay programmer Physics programmer Artificial intelligence (AI) programmer General programmer Tools engineer programmer Network programmer VR/AR programmer Input programmer Port and server programmer UI programmer
Quality assurance and testing	Game testing manager QA engineer Game tester Build engineer
Management, marketing, legal/HR and distribution	Business development director Chief technical officer Monetization manager Brand manager Legal department HR manager Sales and distribution manager Marketing manager Social communication manager Community manager Public relations manager

6. Barriers and Threats

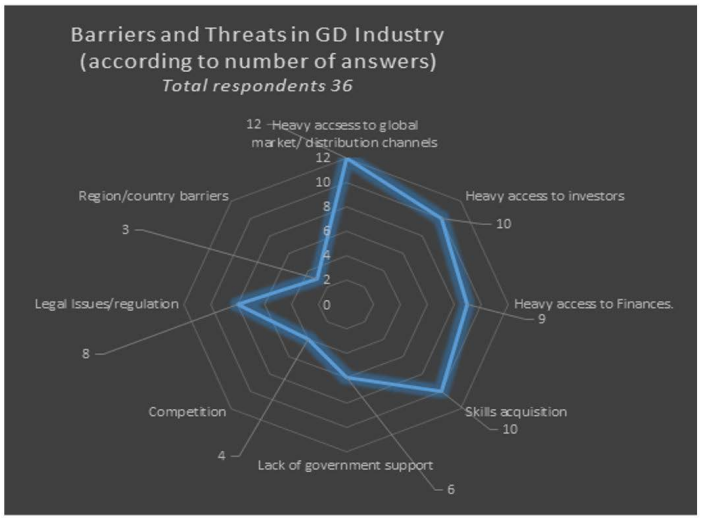
The following barriers and threats were identified by the owners/managers/employees from the GD companies:

- Difficulty in accessing *global markets* and *sustainable distribution channels* that would give game developers access to those global markets;

- Difficulty in attracting domestic or foreign *investors*. Domestic investors are not aware of the prospects in this industry, while external investors do not have enough information about the industry in Macedonia;
- *Finances*. Game development requires materials and a workstation to accommodate the developers. Digital workstations are expensive and, therefore, they are a barrier for game developers. The wages necessary for good professionals are also a barrier. To keep abreast of current consumer expectation expensive equipment is necessary. In addition, high-end games are almost impossible to develop without testing, and testing requires more equipment which may be even more costly than the equipment needed for development. The required software licenses constitute an additional cost;
- *Skills acquisition*. Being successful in this field requires possessing experience in playing games and an understanding in the field of programming and art. A small number of companies/studios exist where game development professionalism can be built. The lack of educational programs for developers, game designers, and game artists hampers GD enterprises;
- *Lack of government support*. The biggest problem is the lack of specific state funds for GD. There are funds to support the film industry, but there is nothing comparable for video games, and the developers report negative experiences with the state FITR fund;
- *Lack of a competitive environment*. Game development is a highly competitive field in which success depends on developing unique products that differ from others on the market. Macedonia suffers from a low level of competition because there are so few GD companies/studios. This also has a negative impact on the professionals in the field because they have limited job opportunities, low wages, long working hours, and society still does not take this profession seriously;
- *Legal issues/regulation*. The industry is further hampered by the risk of double taxation (there being no agreement with the USA in this regard), complicated procedures for the employment of foreign non-residents, high tax levels and problems with money transfer and taxation;
- *Regional/country barriers*. Not being an EU member state puts Macedonia in an unfavourable position and, therefore, it faces irritating hurdles in terms of trade, as explained by one games developer:

“As a partner with PlayStation and Xbox, I face major barriers in delivering DevKit and all other gaming consoles to these consoles. I will soon be forced to open a company in the European Union, so that I can work continuously with these two companies.” (Owner of GD enterprises, 36)

Image 7.

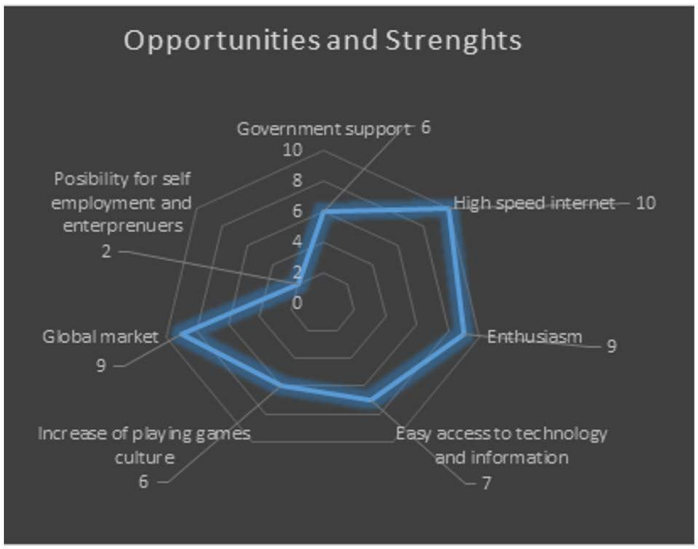


7. Strengths and Opportunities

The companies also identified a number of factors in their external environment that they see as an opportunity for the development of their businesses and the whole game development industry:

- Access to high-speed internet. Macedonia has a decent quality internet;
- Officials/government can help if they try to understand and support this industry, especially with financial and educational support;
- Enthusiasm. GD is a new industry, and one that is growing. The fact that it embraces IT, art and entertainment makes it an attractive career option for creative and enthusiastic people. The abundance of well-educated young people in Macedonia could enable this industry to grow significantly if they were able to access proper training;
- Access to different technologies. The richness and availability of on-line information and the use of on-line technologies in everyday life, such as during shopping, makes video games more easily accessible and understood;
- The rising trend of the development of a culture for playing games and digital distribution. Digital distribution gives developers access to any person anywhere, provided they have an internet connection;
- Access to the global market and publishers. Our respondents all agree that this is the main opportunity and challenge for the GD enterprises/studios. The gaming market is growing rapidly, which means that the pie is getting bigger but more competitive, and the companies must invest a lot in development, production, and marketing in order to succeed;
- There is a wide variety of creative jobs in the GD industry and with proper training many people could have an opportunity for self- employment;
- Because it includes many sectors and it is fast moving, GD can also be an opportunity for entrepreneurs at a national level.

Image 8.



8. HR Supply and Demand Challenges

"Potential candidates are extremely difficult to find…There are a small number of experienced candidates, as well as a great need for training and education. This is forcing us to start thinking about regional expansion." (Owner of a Macedonian game development studio)

The working teams in the Macedonian game development industry differ in size, job profiles, formal structure and type of employment contract. 65% of our respondents had long-term, permanent employment contracts, while the others were on fixed-term or probationary contracts or worked as project freelancers on temporary contracts. Some of them work as independent game developers, without registering a company.

According to the analysis of the data obtained from our interviews, the Macedonian game development studios/companies struggle to find, attract/recruit and select experienced, qualified, and skilled candidates for employment/work engagement. Most of the respondents (managers and/or company owners) agree that there are a small number of potential candidates for the job in the country and even if they succeed in finding them, in most cases, further training and/or education is required.

The respondents emphasized the fact that finding skilled staff depends on the type of job position. For example, it is easier to find programmers (although most are already employed) than artists and developers. The greatest difficulty is to find game designers and one of our respondents reported a lack of experienced QA testers.

They cope with this situation in diverse ways: by engaging candidates from other countries or from other regions; by investing in training/education, if they have the budget for that; or by outsourcing from other companies. Outsourcing is most often used for accounting, publishing, distribution, marketing, SFX, 3D modellers, Pixel art and/or music.

9. Educational Requirements and Current Offer

Regarding formal education, there are nine universities[4] in Macedonia with around 20 faculties where students can study Information and Computer Science, Visualization, Multimedia, Animation, Digital Design, Graphical Engineering, Sound Engineering and Film Production. The analysis of the universities' curricula suggests that several Multimedia and Graphical Design Faculties include study courses in specific skills, such as: typography, illustration and packing, graphics design software for 3D design, web page design and interactive multimedia design, through a combined use of colours, images, text, sound, paper, artwork and motion. However, only one of the faculties has a Digital Design Study Programme that, besides Visual Expression, Visual Design, 3Modelling and Rendering, Video Editing and Manipulation, UI/UX Design, Motion Graphics and Visual Effects, 3D Animation and Production courses, also includes Game Design and Digital Content Copyright courses.

When it comes to non-formal education, the analysis of the data obtained shows that, in addition to courses on general IT skills, most of the IT Educational Centres/Academies[5] offer courses on video game design (some of them are authorized providers for MAYA, Java, Unite, Epic Games: Unreal Engine courses), for both adults and children.

According to the analysis of the data obtained from our interviews, game developers depend on informal as well as formal, non-formal and informal[6] education. Despite the fact that half our respondents graduated from Faculties for Information and Computer Science - in other words, they have a formal education - the vast majority say they acquired their game developer skills through informal learning, such as: Stack Overflow Platform, Udemy Courses, tutorials on YouTube, Hackathons, or CGPeers. Only a few of the respondents had acquired the necessary skills through non-formal educational centres/academies for game design.

Our respondents listed the following video game development skills: shadows, textures, animations, sound, graphic design, software architecture, hardware programming, teamwork, etc. They are relatively satisfied with their existing knowledge and skills using such tools as Adobe Illustrator, Photoshop, 2D design, SolidWorks, and in fields such as 3D Design & Render. However, some of them emphasized the need for greater familiarity with tools such as Maya, Unity, C#, and a deeper understanding of disciplines in linear algebra, physics, and other fields. They firmly believe that the success depends on continually learning and updating one's games design knowledge and skills.

Most of the respondents underlined their lack of knowledge in the so-called soft skills. They are very much aware of the fact that in order to be able to communicate with prospective clients and co-workers, or to lead a team, negotiate a contract and get a job done on time, they need to improve their performance in areas such as analytics, project management, communication & prioritization skills, team works, negotiation skills, etc.:

"…I think there is always room for learning new things, but the lack of communication and a consistent hub of people to generate a gaming environment is a problem. There are many individuals and companies that actively contribute to the development of the gaming industry, but there is no sense of collectivity."

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[4] Five (5) of the universities are located in Skopje, and one (1) in Ohrid, Bitola, Shtip and Tetovo, each.
[5] There are 12 academies that offer courses on video game design. Ten (10) of them are located in Skopje and two (2) in Bitola.
[6] https://www.coe.int/en/web/lang-migrants/formal-non-formal-and-informal-learning

10. Financial Sources and Expenses

The game development projects we studied are generally self-financed by the game development companies/studios or the developers as they are still at an early stage and do not generate enough income to finance the development from revenue. Personal investment is the main source of financing for the game design projects, augmented by income from the IT services that some companies provide. Other sources of finances are the profits generated through partnerships with other video publishers and the profits from published games.

The GD companies generate income by selling intellectual services, creating assets, plug-ins and models for sale to other developers; games sales/purchase; advertisements.

The biggest costs incurred are the wages, followed by taxes and equipment.

11. Game Development Industry Support Organizations

Although our respondents are very aware of the fact that they are part of a gaming community that allows the exchange of knowledge, professional contacts, ideas, and mutual assistance that can benefit the whole industry, the vast majority are not members of any official domestic or international networks, hubs, or game development associations.

Our data showed that none of the game development companies we looked at are members of any official domestic association, consortia or hubs. We were told that the main reason for not participating is the *lack of trust in the state institutions and in the professional associations.* Some of our respondents are convinced that these associations do not act independently, given that they are politically influenced by the government:

"…Even in the best-case scenario they (the professional associations) have no interest in improving the status of their members."

When asked directly if they cooperate with some of the state institutions and/or public funds, in particular the Fund for Innovation and Technological Development (FITD)[7], almost all our respondents, who are owners of companies, answered that they do not have any kind of cooperation, nor do they apply for financial support in the form of grants and subsidies from the state institutions and/or funds. The main reason stated is the lack of trust in the state institutions and public funds, based on a prior bad experience with the Fund for Innovation and Technological

[7] https://fitr.mk/en/elementor-13617/
The Fund for Innovation and Technology Development (FITD) was founded in December 2013, for the purpose of encouraging innovations by provisioning additional sources for innovation funding and due to the need to build a competitive economy based on knowledge. The mission of the Fund for Innovation and Technology Development is to encourage and support innovation activity in micro, small and medium-sized enterprises in order to ensure hastened technology development based on knowledge transfer, research and development of innovations which will contribute to the creating of new jobs and ensuring economic growth and development and at the same time improving the business environment for the development of the competitive abilities of the companies. According to the data on projects co-funded by FITD in the period 2015 – 2021, the total project value is EUR 88.25 million. From the total value, EUR 49.32 million (55%) are cofunded by FITD, while EUR 38.93 million (45%) are funds allocated from the companies. In the respective period, financial support was provided for 669 projects PowerPoint Presentation (fitr.mk)

Development (FITD) or negative 'word-of-mouth':

"...Funds are too much hassle for no real gain. We do not want to be blackmailed. We value our professional freedom."

"...We applied to FITD only once and the bad experience that we faced deterred us from further communication with any other state institutions, thus avoiding any interaction with the government."

"...We have not applied to FITD or any other fund/state institution due to their excessive politicization and unqualified decision makers."

However, our analysis showed that two game development companies did receive a grant from FITD and one from the Bulgarian start-up accelerator LAUNCHub[8].

When asked what incentives, grants, subsidies and/or other state policies could contribute to the overall improvement and growth of the video game industry, our respondents (both game developers and owners of the companies) emphasized initiatives in the education sector, particularly formal education, followed by tax reliefs and the establishment of a state game development fund, etc.:

- Introduction of modern university game design curriculums;
- Introduction of game-development courses in the educational system starting from the level of primary school;
- Tax relief in order to attract foreign companies and investments;
- Establishment of a video game development fund in order to support the video game industry;
- Business incubators;
- Membership fee financial support for international associations and networks.

The respondents also emphasized the need to establish a hub of Macedonian experts/practitioners, financially supported by the state:

"…A hub of Macedonian experts must be set up where video game developers could easily approach and ask for any kind of assistance. These experts should be paid by the state for their engagement."

12. Prospects for Career Development

"Excellent progress in a dynamic, fast-growing industry, where one's qualities, desire & ambition quickly come to the surface."

Most of our respondents are satisfied with their profession, in terms of solid wages and opportunities for professional and career development. But, at the same time, many of them stressed that their income is not regular and that collaboration with foreign companies is crucial, as there are relatively few opportunities for work in the country.

[8] See the list of identified game development companies.

As main advantages of the profession they listed the following: fun at work, flexible work schedules (remote work), creativity, solid incomes, opportunities for career development, continuous learning, teamwork, global networking, and visible/tangible results.

The main downsides mentioned were: the very low number of companies in the country due to which job opportunities are limited, the deficiency of skilled and experienced workers in the country (as a result of which one person often has to perform multiple jobs/tasks), heavy workloads, and demanding bosses.

Almost all the respondents see their professional future in the game development industry, though there are divided opinions as to whether that means working in Macedonia or abroad.

13. Intellectual Property Rights

Intellectual property (IP) is the most important branch of the law on videogame developers and publishers. IP is a vital element of videogame development contracts, employment agreements, distribution, advertising, and every license in the game industry. *Copyright* is arguably the most important form of IP protection for most game companies. Game developers can use copyright to protect their ideas, build new games, and sell related products, with protection lasting up to a hundred years. *Trademarks* are arguably the second most important IP protection for game companies after copyright, since a good trademark can set a company and its games apart from others in the minds of consumers. In fact, a successful trademark is one that allows consumers to instantly recognize the company and its products. Although extremely important for some hardware, software, development tools and other middleware companies, patents are not used as often in the game context. Patents do not usually protect games themselves because they do not usually meet the statutory criteria. Yet, there are a growing number of game-related patents, usually in the areas of hardware, digital distribution, networking, and inventive gameplay[9].

According to a qualitative analysis, 35% of the employees/freelancers/MAGDA representatives as respondents (total sample N=26) do not own any intellectual property rights for the developed games, 23% do not know/are not sure, 8% own intellectual property rights only for some of the games they have been working on, and 34% own intellectual property rights (sole or joint ownership). Within our other research target group – owners of game development companies/studios (a total sample of ten) 100% of the respondents answered that they own intellectual property rights, giving them either sole or joint ownership.

[9] Read more: Mastering the Game: Business and Legal Issues for Video Game Developers (wipo.int)

14. About the Macedonian Games (Platforms, Publishers, Success and Global Competitiveness)

The owners of companies comprised in our sample are satisfied with the success of their games. They believe their products are very high in quality and low in price (and costs), which makes them globally competitive.

Despite the strong focus on mobile games, available on Google Play Store and Apple App Store, Macedonian game developers/companies design games for other platforms, too. There are Macedonian video games which are available on Steam, Xbox, iOS, Android, Nintendo Switch, PC/Windows/Microsoft store, Linux, Nintendo Wii U, PlayStation 4, PlayStation 5. Multi-platform development is also very common.

According to our interviews, 40% of the respondents/owners of studios publish their games independently while 60% use other publishers.

15. Relevant Associations/Chambers/Unions in the Country

MACEDONIAN GAME DEVELOPERS ASSOCIATION – MAGDA is a non-government organization established in 2013 to meet the needs of the game development community in Macedonia.

In the past years, they have organized numerous events including:

- **Global Game Jam,** 10 events in the period 2013-2022. This is the world's most important game jam event in a form of a 48+ hour game development marathon. It is held annually, in almost every country, on the last weekend of January. The participants organized in teams work on the same theme and develop prototypes of a game. In the past years, the event was held on locations in Skopje, Bitola, and Ohrid, as well as an online event.
- **Game Razviotka** (Game Bodybuilding), 3 events in the period 2014-2015 in collaboration with Seavus Educational and Development Centre – SEDC in Skopje. The events were one-day educational conferences, at which professional game developers from Macedonia gave lessons to students and young game developers.
- **T-Home Game Weekend,** a whole weekend conference in collaboration with Makedonski Telekom. The event covered themes about game design, programming, digital art, and sound design. The lessons were given by renowned Macedonian professionals with international experience. The event was held in Skopje.
- **Game Jam Plus** is an event that was introduced in 2021 as an online event. This international event has a different concept from the other game jams because it lasts

seven months and it has 3 stages (a country competition, continental semi-finals, and the world final), as well as an acceleration phase.

Although this industry is young in Macedonia, there is a large community of people interested in developing digital games. In terms of participants per million of population, the Macedonian Global Game Jam events regularly rate very highly, coming in 5th in the world rankings, a position which might be expected in countries with more advanced game industries. Moreover, MAGDA's debut year at Game Jam Plus resulted in Macedonia being the country with the largest number of participants, which enabled five teams to get mentorship and compete in the European semi-finals.

Game Developers Hive, situated in Bitola, was a collaborative project between MAGDA and GAUSS Institute Bitola. It was a game development incubator and educational centre, which in the period of 2015 – 2019 offered working space, equipment, and mentorship to young game developers from Bitola and the nearby region. The Hive organized educational courses and it was also a gathering place for the Bitola game development community.

Besides the official events, together with the company Indium Games (former NapNok) and Dark-1 Studio, they took part in organizing **Indie Beer MeetUp,** informal gatherings for the community in Skopje. It allowed people to meet in person, exchange opinions, and present their work.

One of MAGDA's main goals is to attract students and young people that have an interest in informatics, arts, or digital games, to try to develop their own games. At the events, they meet people from all over Macedonia and many of them get inspired to choose digital games for further education and as a profession.

As the game development sector in Macedonia grows strong, MAGDA will continue to work towards its expansion, helping individuals, teams and companies get whatever they need, creative and business wise.

Website: www.gamejam.mk, Facebook page: https://www.facebook.com/MAGDA.Macedonia

Facebook page of the Game Developers Hive: https://www.facebook.com/hivemk/

MACEDONIAN CHAMBER OF INFORMATION AND COMMUNICATION TECHNOLOGIES - MASIT is a volunteer, non-profit chamber of commerce. The chamber was founded in 2000 as an initiative of the top fifteen Macedonian IT companies and it has been operating as an Association within the Economic Chamber of Macedonia. In April 2007, on the Annual Assembly of MASIT, the legal transformation of MASIT from an association to a chamber of commerce was agreed.

Today, MASIT is the voice of the Macedonian ICT industry. The chamber represents companies of the ICT sector in Macedonia including: software and IT services companies, hardware companies and distributors, carrier and other telecom companies, as well as training providers and ICT consulting companies. In its portfolio, MASIT also covers companies that develop solutions for the gaming industry, animation, digital arts, and digital design.

Website: http://www.masit.org.mk/

UNION OF MACEDONIAN PROFESSIONAL ASSOCIATIONS IN THE CREATIVE INDUSTRIES – UMPACI

Members of the Union may be representative professional organizations in the field of creative industries that meet the criteria set out in the special membership regulative. UMPACI believes

that it is very important to foster creative industries, as the creative economy is growing faster than any other economic sector, and to keep up with the endless demand for innovation and complex creative work, which is difficult to be automated.

The cultural and creative sector is important for ensuring the continued development of society and it is at the heart of the creative economy. Intensive knowledge based on individual creativity and talent generates a significant economic wealth; and more importantly, it is the key to a common understanding of the European identity, culture and values. Innovation acts as a catalyst, especially for the young, and it strengthens social cohesion. This creates changes in other sectors and stimulates inventory and progress in the European diverse cultural landscape.

With the emergence of creative business models, cultural and creative sectors are increasingly becoming a decisive component of almost every product and service.

Website: https://umpaci.com/

16. Conclusions

- Accurate Data

The GD sector in the country is poorly covered by the existing SIC codes in the National Classification of Economic Activities and it is hard to find relevant data using official sources like the Central Registry of Business Entities and the State Statistical Office. There are a number of new occupations emerging in the GD industry, but most of them are not included in the National Classification of Occupations (SOC) in the country. For those occupations that are included in SOC, there is no available official statistical information on the 4-digit level code.

- Barriers and Threats

Gaming is one of the fastest-growing industries in today's world. But even though it may look good from the outside, this industry is also facing significant challenges. The following barriers and threats were identified by the owners/managers/employees of the game development companies: difficulties in accessing global markets and sustainable distribution channels; difficulties in accessing domestic and foreign investors; difficulties in accessing finance; the lack of a skilled workforce; lack of government support; a highly competitive global market versus low levels of competition in the domestic market; obsolete and unfriendly legal regulations in the country; regional and national trade barriers.

- Opportunities and Strengths

Factors that can be seen as opportunities and strengths for the development of the businesses and the GD industry as a whole are: the access to high-speed internet; the willingness of the national officials/government to help with funds and educational programmes; the enthusiasm of the involved professionals; the abundance of on-line information on the latest technologies; the rising trend of development of the gaming culture and the possibilities for digital distribution; the access to the global market and publishers; the opportunity for country entrepreneurs.

- HR Supply and Demand Challenges

The Macedonian game development studios/companies struggle to find, attract/recruit and select experienced, qualified, and skilled candidates for employment/work engagement in the

country. They need resources that will help them to attract, develop and retain talent in their organizations. This will provide them with a competitive advantage and sustainability. But primarily they need skills and competences to know how to select and recognize talent.

- Job Satisfaction and Prospects for Career Development

Most of our respondents are satisfied with their careers in this industry, in terms of solid wages and opportunities for professional and career development, and see their professional future in the industry. But many of them also stressed that their income is erratic and that collaboration with foreign companies is crucial, as there are too few opportunities within Macedonia.

- Education

There are 20 faculties where students can acquire skills in Information and Computer Science, Visualization, Multimedia, Animation, Digital Design, Graphical Engineering, Sound Engineering and Film Production. However, only one of the faculties offers a Game Design and Digital Content Copyright study course.

Even though half of the our respondents have formal education, i.e., they graduated from the Faculties for Information and Computer Science, the vast majority say they have acquired their game developer skills through informal learning and only a few through non-formal education i.e., centres/academies for game design. The respondents emphasized their need for greater competencies in Maya, Unity, C#, General Data and Numbers Understanding, linear algebra, physics, etc. Most of them also underlined their lack of knowledge of soft skills.

- Financial Sources and Expenses (Costs)

The games design projects are generally self-financed by the development companies or the developers as they are still in an early stage and do not generate enough income to finance the development from earned revenues. The companies generate income by selling intellectual services, creating assets, plug-ins and models to other developers; game sales; ads; in-game purchase. The biggest costs incurred are the wages, followed by taxes and equipment.

- Game Industry Supporting Organizations

Due to the lack of trust in the state institutions and/0r professional organizations, the vast majority of game developers, as well as the identified companies, are not members of any professional associations nor do they cooperate with any of the government institutions and/or public funds.

- Intellectual Property Rights

Owners or Macedonian game development companies do have knowledge about their intellectual property rights and do possess ownership of the rights for their products (games), but this is not the case with the freelancers/employees.

- About the Macedonian Games

The Macedonian games achieve global success and competitiveness mainly because they are present on different platforms, and combine high-quality with low prices (some of them are free of charge).

17. Recommendations

Data

- **More comprehensive and accurate data** are essential for the industry's future. National institutions, such as the State Statistical Office, must improve the data collection on SIC and SOC, based on the 4-digitlevel code, and give greater access to this data which would assist measurement and management in both short-term and longer-term planning for the workforce demand and supply, new skills, relevant vocational training programs and guidance, and other issues.

Education and Skills

- **New university curricula** are needed in fields such as game design and/or games development. To address the lack of soft skills, courses are also needed in analytics, project management, communication & prioritization skills, teamwork, negotiation skills, conflict management skills, client orientation skills, time management skills, digital content copyright, etc., both in formal and non-formal education. Our respondents identified artists, designers and QA testers as being three areas where there are particular skill shortages. To sustain the industry in the long term, it is also necessary to encourage creative and innovative thinking in primary schools through the introduction of courses with a special emphasis on digital art and drawing[10].
- **Organizational capacities** need to be strengthened within the game development enterprises. There is a need to improve the internal process/method /support for project planning and control and encourage greater collaboration between the various involved disciplines, i.e., engineers and artists. The industry requires a wide range of disciplines, from the creative arts and content design to software and coding skills. Improving team collaboration and process support is an ongoing challenge to enable a more comprehensive understanding of game development projects. The lessons learned from software engineering practices can help game developers improve their processes within a heterogeneous environment. New management methods could help create a more friendly culture that would attract talented people and offer them a place to grow and flourish.
- **Creative entrepreneurship** should be stimulated by providing campaigns, training, workshops, and business start-up grants for cultural entrepreneurs. The World Creativity Day, marked on 21st April of each year, should be celebrated in the country as a day on which creative businesses and education institutions are celebrated and promoted. It could reflect well on Macedonia's international image to be seen as a participating country.

Finance

- **Financial support from the government** for membership fees of international associations and professional networks would encourage the game developers and game development companies to become a part of a wider gaming community that

[10] E.g. 21st Century Schools: improving classroom practice | British Council. While being run in partnership with relevant educational institutions in each country, the programme aims to equip one million students aged 10-15 years across the Western Balkans with critical thinking and problem-solving skills. In addition to learning critical thinking and problem-solving skills, children will also learn practical programming skills and have the opportunity to practice their skills through physical computing.

would assist the exchange of knowledge, professional contacts, ideas and mutual assistance. Similarly, support for international sales and distribution and/or support for companies attending international trade shows and competitions would benefit the industry.

- **Tax incentives and tax relief policies** are especially important and there are world-wide examples of their positive impact on game development. The UK, Germany, Canada and Australia, all provide tax reliefs. Similar policies in Macedonia would attract foreign investment and thereby strengthen the industry.
- **FITD.** An attempt should be made to build a better relationship between the **Fund for Innovation and Technology Development** and the game development industry.

Industry Support

- **A hub for experts and practitioners** and/or a business incubator could help start-up companies and entrepreneurs develop their businesses by providing a range of support services. New game development companies, independent game developers and freelancers require legal assistance and guidance, particularly in registering a company, understanding the privacy policy, managing international money transfers, and managing sole or joint ownership of their intellectual property rights (in the form of copyright, trademark, or patent).
- **An online platform or database** would make the Macedonian game development companies, independent developers, and freelancers - and their products - more visible and easier to reach. Resources would be needed to ensure that its regular updating.
- **MAGDA** should further develop its capacities, increase its membership, and network with other game development associations on an international level, including, for example, the European Games Trade Association. MAGDA should strive to have a significant role in representing the interests and concerns of the industry to Government.
- **Support for marketing.** The success of any game depends on how effectively it is promoted, even where the costs of development and production are low. As a general rule, the marketing costs need to amount to at least 30% of the overall budget to reach a target audience successfully, and many big publishers invest more in marketing than in development. With so many young and start-up companies in the Macedonian industry, consideration should be given to providing forms of short-term market support to help the industry achieve the critical mass it needs to become sustainable and internationally successful.

APPENDIX 1

Current Educational Offer – List of Non-Formal and Formal Education Providers

SEMOS[11]

Website: Семос Едукација (semosedu.com.mk)

Contact: kursevi@semos.com.mk

M3DS[12]

Website: https://mk.m3dsacademy.com/

Instagram: M3DS Academy (@m3dsacademy) • Instagram photos and videos

Algorithmics[13]

Website: https://gazibaba.alg.academy/

SEAVUS EDUCATION END DEVELOPMENT CENTRE

Website: https://www.sedc.mk/academy/academy-for-design/3d-animator/?lang=mk

Contact: sedc@seavus.com

FX3X

Website: Fx3x – animation, cg, vfx, visual effects

Contact: fx3x@fx3x.com

DJOLEV AND THE ARTS

Website: https://djolevandthearts.edu.mk/academy/akademija-graficki-dizajn/

Contact: info@djolevandthearts.edu.mk

BRAINSTER

Website: https://brainster.co/graphic-design/

Contact: contact@brainster.co

[11] Authorized provider of UNITY and Maya courses.
[12] Authorized provider of Unreal Engine (Epic Games) courses.
[13] Game design and development courses for 10-11 years old children.

REWOK

Website: https://rework.mk/about

Contact: contact@rework.mk

CREATIVE HUB MACEDONIA

Website: https://creativehub.mk/

Contact: contact@cretivehub.com

JAVEN ADVERTAJSING BITOLA

Website: Home (javen-advertising.com)

Contact: contact@javen.mk

VISUAL SIDE LLC SKOPJE[14]

Website: https://www.thevisualside.com/

Contact: +38975368661 Viber/ WhatsApp

CODEART

Website: https://codeart.mk/about/

Contact: contact@codeart.mk

VIZIJA

Website: https://vizija.mk/

Contact: info@vizija.mk

EVEREST WEB ACADEMY

Website: https://everest.mk/

Contact: contact@everest.mk

GAME DEVELOPERS HIVE

Website/fb: https://www.facebook.com/hivemk/

[14] Mixed capital (foreign and domestic).

EDUFRONT

Website: https://edufront.mk/

Contact: info@edufront.mk

DIFFERENT ACADEMY

Website: https://academy.different.com.mk/mk/

Contact: +389 76 33 66 66, +38978 399 947

NEW MAN'S BUSINESS ACCELERATOR

Website: https://newmansba.com/

Contact: europe@newmansba.com

KEY CODE

Website: http://www.keycode.mk/

DIGITAL SCHOOL

Website: https://digitalschool.com.mk

Contact: info@digitalschool.com.mk

MEGASOFT PLUS BITOLA

Website: Мегасофт (megasoft.com.mk)

Contact: +38947 25-25-25, +38947 61-26-53, +38947 61-26-57

PULSAR[15]

Website: http://www.pulsar.com.mk/

Contact: info@pulsar.com.mk

IW EDUCATION CENTER

Website: https://iwec.mk/

Contact: iwec@iwconnect.com

[15] Provider of Java courses.

VIRTUAL M KUMANOVO

Website: Virtual-M - Home (weebly.com), Account Suspended (virtual-m.edu.mk)

ALGORITAM STRUGA

Contact: +389 46 784200

E-NET edukacija

Website: https://e-net.mk/

Contact: edukacija.info@e-net.mk

STATE HIGH SCHOOL FOR ART AND DESIGN

Website: ДСУЛУД Лазар Личеноски - Средно Уметничко Училиште (lazarlicenoski.mk)

Contact: +389 2 3118 490

STATE MUSICAL - BALLET EDUCATIONAL CENTRE - SKOPJE

Website: ДМБУЦ „Илија Николовски - ЛУЈ“ (dmbuc.edu.mk)

Contact: dmbuc.mkd@gmail.com

STATE SCHOOL FOR MUSIC - BITOLA

Website: Државно Музичко Училиште – БИТОЛА (muzickobitola.edu.mk)

Contact: muzickouciliste@yahoo.com

STATE MUSICAL EDUCATION CENTRE - SHTIP

Website: Уписи – ДМУЦ „СЕРГЕЈ МИХАЈЛОВ“ – ШТИП (sergejmihajlov.edu.mk)

MATHEMATICAL-IT GYMNASIUM

Website: https://mig.mk/

Contact: info@mig.mk

ELECTRO-TECHNICAL HIGH SCHOOL "MIHAJLO PUPIN"

Website: СЕТУ "Михајло Пупин" | Скопје (mihajlopupin.mk)

Contact: mpskontakt@yahoo.com

Ss. CYRIL AND METHODIUS University – Skopje

FACULTY OF COMPUTER SCIENCE AND ENGINEERING:

Bachelor's Degree https://finki.ukim.mk/en/dodiplomski-studii

Master's Degree https://finki.ukim.mk/en/magisterski_studii

Doctoral Degree https://finki.ukim.mk/en/doktorski_studii

FACULTY OF ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGIES:

Bachelor's Degree https://feit.ukim.edu.mk/en/undergraduate-studies/

Master's Degree https://feit.ukim.edu.mk/en/postgraduate-studies/

Doctoral Degree https://feit.ukim.edu.mk/en/phd-studies/

FACULTY OF NATURAL SCIENCES AND MATHEMATICS:

Bachelor's Degree https://www.pmf.ukim.edu.mk/tabs/view/ca64f17e67664c-1550821c5b71ff3570

FACULTY OF DRAMATIC ARTS:

Study Programme - Production

Bachelor's Degree http://www.fdu.ukim.edu.mk/index.php?mn_sel=do_prod

Master's Degree http://www.fdu.ukim.edu.mk/index.php?mn_sel=pos_st

UNIVERSITY OF AMERICAN COLLEGE - Skopje (UACS)

SCHOOL OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY:

BSc in Software Engineering https://uacs.edu.mk/home/bsc-in-software-engineering/

BSc in Computer Networks https://uacs.edu.mk/home/bsc-in-computer-networks/

BSc in Management of Information Systems https://uacs.edu.mk/home/bsc-in-management-of-information-systems/

BSc in IT Management https://uacs.edu.mk/home/bsc-in-it-management/

Msc in Software Engineering https://uacs.edu.mk/home/msc-in-software-engineering/

Msc in Robotics https://uacs.edu.mk/home/msc-in-it-management/

Msc in Management of Information Systems https://uacs.edu.mk/home/msc-in-management-of-information-systems/

PhD in Information Systems and Management https://uacs.edu.mk/home/phd-in-law/

ST. PAUL THE APOSTLE – UNIVERSITY OF INFORMATION SCIENCE AND TECHNOLOGY – Ohrid https://uist.edu.mk/

FACULTY OF INFORMATION SYSTEMS, VISUALIZATION, MULTIMEDIA AND ANIMATION:

Bachelor's Degree https://uist.edu.mk/academics/bachelors/isvma/

(Computer animation, visualization, design, computer graphics, multimedia and animation)

FACULTY OF COMPUTER SCIENCE AND COMPUTER ENGINEERING:

Bachelor's Degree https://uist.edu.mk/academics/bachelors/cse/

FACULTY OF APPLIED IT, MACHINE INTELLIGENCE AND ROBOTICS:

Bachelor's Degree https://uist.edu.mk/academics/bachelors/aitmir/

FACULTY OF COMMUNICATION NETWORKS AND SECURITY:

Bachelor's Degree https://uist.edu.mk/academics/bachelors/cns/

Master's Degree https://uist.edu.mk/academics/masters/cns-master/

FACULTY OF INFORMATION AND COMMUNICATION SCIENCE:

Bachelor's Degree https://uist.edu.mk/academics/bachelors/ics/

Master's Degree https://uist.edu.mk/academics/masters/ics-master/

St. KLIMENT OHRIDSKI UNIVERSITY – Bitola

FACULTY OF TECHNICAL SCIENCES:

Study Programme - Graphical Engineering:

Bachelor's Degree, Master's Degree and Doctoral Degree http://www.tfb.edu.mk/tabs/view/c5bf71405fc8cd50d8bcaa5d9901926b?l=eng

UNIVERSITY GOCE DELCEV – Shtip

FILM ACADEMY / DEPARTMENT OF FILM PRODUCTION:

Bachelor's Degree https://fa.ugd.edu.mk/index.php/mk/studiski-programi/prv-ciklus

FACULTY OF INFORMATION SCIENCE:

Bachelor's Degree http://fi.ugd.edu.mk/studii/prvCiklus

Master's Degree http://fi.ugd.edu.mk/studii/vtorCiklus

Doctoral Degree http://fi.ugd.edu.mk/studii/vtorCiklus

INTERNATIONAL BALKAN UNIVERSITY – Skopje

FACULTY OF ENGINEERING / DEPARTMENT OF COMPUTER ENGINEERING:

Bachelor's Degree, Master's Degree and Doctoral Degree https://www.ibu.edu.mk/feng/

FACULTY OF ART AND DESIGN / DEPARTMENT OF GRAPHIC:

Bachelor's Degree, Master's Degree

The department of Graphic Design includes courses that teach students specific skills including typography, illustration and packing, as well as the use of graphics design software for 3D design, web page design and interactive multimedia design, through a combined use of colours, images, text, sound, paper, artwork and motion.

SOUTHEAST EUROPEAN UNIVERSITY – Tetovo

FACULTY OF CONTEMPORARY SCIENCES AND TECHNOLOGIES:

Study Programme - Digital Design: Visual Expression, Visual Design, 3D Modeling and Rendering, Video Editing and Manipulation, UI/UX Design, Motion Graphics and Visual Effects, 3D Animation and Production, Game Design, Digital Content Copyright.

Bachelor's Degree

https://www.seeu.edu.mk/en/future-students/academics/undergraduate?id=263

Study Programme – Computer Science:

Bachelor's Degree https://www.seeu.edu.mk/en/future-students/academics/undergraduate

Master's Degree https://www.seeu.edu.mk/en/future-students/academics/postgraduate

Doctoral Degree https://www.seeu.edu.mk/en/future-students/academics/phd?id=221b

EUROPA PRIMA INTERNATIONAL UNIVERSITY – Skopje

FACULTY OF FILM ARTS:

Department of 3D Animation - Bachelor's Degree, Master's Degree

Department of Sound Engineering - Bachelor's Degree, Master's Degree

Department of Film and Digital Media - Bachelor's Degree

Department of Production and Management - Bachelor's Degree

https://www.europaprima.com/

AMERICAN UNIVERSITY OF EUROPE (AUE – FON)

SCHOOL OF DESIGN AND MULTIMEDIA:

Bachelor's Degree, Master's Degree https://fon.edu.mk/content.aspx?cid=35&ln=en

(digital video, editing, audio, animation)

School of Communication and IT:

Bachelor's Degree, Master's Degree https://fon.edu.mk/content.aspx?ln=en&cid=33

APPENDIX 2

Alphabetical List of Macedonian Studios/Independent Game Developers (and Their Games)[16]

4VIRTUS

Website: 4VIRTUS.COM - Solutions made of heart and mind: Software development, http://www.beeclever.mobi/

Contact: contact@4virtus.com

Game: **BeeClever** is a unique concept for early education of children through fun games. BeeClever games focus on preschool education and children aged 3–7. It is an Android app.

CrazyLabs[17] (previously TabTale)

Web: Skopje | Crazy Labs

Contact: developers@crazylabs.com; support@crazylabs.com

Games: CrazyLabs focuses on 2 hugely popular lines of mobile games:

1. Hyper-Casual Games
   As "**Phone Case DIY**", "**Acrylic Nails**", "**ASMR Slicing**", "**Soap Cutting**", "**AMAZE!**", "**Run Sausage Run**" and many more.
2. Casual Games
   "**Miraculous Ladybug & Cat Noir**" (based on the popular TV series), "**Jumanji**" (based on the popular 'Jumanji' movie series) "**Hotel Transylvania Adventures**" (also based on the popular TV series) "**Super Stylist**" and other casual hit games.

DARK-1

Website: https://dark-1.com/?fbclid=IwAR1UkvLcC6JqF-R0UoMTp-4XAwdl9FiqMMO_HiTDod-9tIY3U3kwHpj9pW6w

Contact: contact@dark-1.com

Games: **Skopje** - is a comic book styled First Person Shooter with roguelite elements and an open-ended world gameplay. It is financed by the Fund for Innovation and Technology Development (FITD). **Odium to the Core** is a challenging single-button, music based game with a dark monochromatic art style. Both games are available on Steam.

[16] All information/data and images in this section are taken from the official websites/portals/platforms as of April 2022.
[17] CrazyLabs has offices in Israel, China, Macedonia, Germany and Ukraine, and it has hyper-casual gaming hubs in India, Turkey, Serbia and Cape Town.

Dimitar Mitrov – independent developer

Games: **BUKVI** is an educative game for young children, in which they can learn the letters/alphabet in Macedonian language. **Balloon Boom Math** is an educative game for young children, where they can learn math by playing. Both games are available on Google Play.

Endi Milojkoski - independent developer

Website: Raining Blobs, arcade puzzle game for PC, Mac & Linux

Games: **Raining Blobs** is a 1-16 player arcade, challenging puzzle game that includes falling blobs and is inspired by the Japanese classics. The game is critically recognized by prominent sites, and it is available not only on Steam, but also through Itch.io, Xbox, Xbox One, and Google Play. Publisher: http://www.blackshellmedia.com/

FURIOUS AVOCADO

Website: Furious Avocado https://furiousavocado.com/

Contact: contact@furiousavocado.com

Publisher: Crazy Labs

Games: **TIE DYE** - It is a video game, a worldwide mega hit that has climbed to the top of Google Play and App store in six months, with over 150 million downloads! The game recently received the 2020 Best Casual Game Award from the Chinese Media Group, Game Cha Guan, and **CANDLE CRAFT**, a simulation game also available for download on Google Play and App store.

INDIUM PLAY

Website: Indium Play QA

Contact: info@indiumplay.com

Indium PLAY is a Quality Assurance studio based in Copenhagen, Denmark, and Skopje, North Macedonia.

INTETIC

Website: https://www.intetic.com/

Contact: info@intetic.com

Games: **Strange Story of Brian Fisher** is a puzzle/mystery/adventure game (type of “Escape Room”) with a story behind.

Jovan Jovanovski – independent developer

Games: **Galaxy Wars** is a free Android video game. Galaxy Wars has 60 levels in which the

player will deal with over 15 different types of enemies. **Puzzle Hub** is a collection of 7 logical games (Sudoku, Word Search, Snake, Minesweeper, Cross Sum, Futoshiki, Color Link.). It is available on iOS and Android.

KAMAi MEDIA

Website: Kamai Media (kotevski.net)

Contact: info@kamaikamai.com

Games: **Sonder.** (a.k.a. The Station) is a third-person action-adventure game. It is supported by the Fund for Innovation and Technological Development (FITD).

Karton Games

Website: https: http://kartongames.com/

Contact:

Games: **BOB RG 42** is an action-adventure game available on Steam. Platforms: PC, Mac, Linux. The game is played in a third person view using the keyboard and a mouse.

Koloss Kolektiv

Website: http://kolosskolektiv.com/

Contact: vanguard@vanguardsolutions.info

Games: **Slimebrawl** is one-against-all brawler and can be played between 2 and 4 players.

M-tech entertainment

Website: Battle For Giostone

Contact: battleforgiostone@gmail.com

Game: **Battle for Giostone** is a multiplayer online battle arena (PC game in pre-production phase & GDD) that uses NFT (non-fungible tokens).

Maximus Ludos Studios [18]

Games: **Echoes world** is an adventurous maze-style puzzle game. The game has been warmly accepted by iOS users from around the world, to the point that Echoes World was at one point in 1st place as the best-selling game in Croatia, Bulgaria, and Macedonia, and in the top 10 in the Netherlands.

MYSTIVE STUDIOS

Website: Mystive Studios - itch.io https://mystivestudios.itch.io/

[18] Macedonian game development studio with headquarters in Amsterdam.

Games: Alan Sharp is a first-person mystery horror story, focused on research, survival, puzzle-solving and open-world investigation. It is made with 0$ external funding, completely financed by the team behind it. The game is performing well, as it approaches 2,000 wish lists on the most popular Steam platforms. Wipe: Toilet plagues is a multiplayer shooter game about Coronavirus and quarantine, playable via a Steam Account.

NapNok Games[19]

Website: https://napnokgames.com/

Contact: info@napnokgames.com

Games: Frantics is a PlayLink party-game, developed in partnership with Sony XDev. The game is a mini-game collection with genres ranging from frenetic action arena brawls to equally frenetic strategic turn-based games. Chimparty is a hilarious party game for up to four players with pick-up-and-play one button mini games, easily controlled through a smart phone. It is art of the PlayLink for PS4 range.

TESSERACT INTERACTIVE[20]

Website: Tesseract Interactive - Crunchbase Company Profile & Funding

The Best Competitive Esport Games to Bet On (excubitorgame.com)

Contact: teamtesseract@gmail.com

Game: **Excubitor** is a Sci-Fi game with intense action, fun and simple gameplay made with an enticing visual style. It is suitable for all today's players as well as lovers of older arcade games. In addition to Windows, Excubitor is also available to Linux and Mac users.

THREE CATS GAMES

Website: Mathstones Memory (threecatsgames.github.io)

Contact: threecatsgames@gmail.com

Games: So far, it has several free games at the Google Play Market such as **Mathstones, Clouds, Shape, Air Balloon** and **Four Sheep**, but it achieved its greatest success in gaming with Mathstones Memory and UFO. The games are written in ActionScript 3, AIR framework, and then ported for Android.

SINDEX

Website: https://sindex.co/

Contact: hello@sindex.co

[19] Macedonian game studio with headquarters in Copenhagen, and offices in Skopje, and Minneapolis.
[20] They moved significantly closer to that goal last year when they received a grant from the Bulgarian startup accelerator LAUNCHub, which, after making sure of the potential and quality of this product, decided to invest 30,000 euros in its further development.

Games: **SciGirl: The Internship.** It's a 2D action-adventure platformer game about a Science Girl. Platforms: Nintendo Switch, Xbox Series X|S, Xbox One, PlayStation 5, PlayStation 4, PC. **Goblen** - A puzzle game inspired by the lights of skyscrapers, Goblen is the best non-ogram game on the mobile market. **ESA Kids Games** - Educational games for kids through which they learn about the work that the European Space Agency is doing and their missions to outer space. **Quiz Map** - Turn-based quiz game consisting of several rounds during one game. **Cavern Gems Match 3** - Game based on the Final Frontiers board-games Cavern Tavern and Rise to Nobility. **15 seconds** - Multiplayer challenge.

Slavko Zdravevski & Petar Rajchinovski

Games: **Logic Booster** is a Macedonian Android video game. Part of the game consists of puzzles, memory games, and mathematical challenges. The game is primarily intended for the youngest, but adults can also use it to check their intellectual abilities. **Balloon ZigZag Game** is an arcade game designed for all ages.

Snowball Games

Website: https://snowballgames.io/

Contact: Contact - Snowball Games

Games: **Yatzy Dice Clash** comes with an enhanced core Yatzy gameplay spiced up with collectible cards. **Pocket Rocket** is a minimalistic arcade racing game in which you try to achieve the fastest time possible by manoeuvring through tough hand-crafted levels. **Farkle Battlefield** is an original version of the classic Farkle game. **Bounce the Bounce** is a fast-paced, bouncing-based game with a top-notch design. **Apex Cube** - A casual game with a character jumping through a maze of obstacles. **Light the Light.** The games are currently available on iOS and Android.

WORKBENCH ENTERTAINMENT

Website: Workbench Entertainment | Official Website (workbench-ent.com)

Contact: contact@workbench-ent.com

Games: **Wolfsbane** is a first-person, multiplayer, co-op survival video game where teamwork and quick thinking ensure victory. Wolfsbane will be available to play on several platforms, consoles, and mobile phones, and it can also be downloaded from Steam. **Wounded - The Beginning** is a survival horror game. This game has received a nomination for the CEEGA (Central and Eastern European Game Awards), and Workbench Entertainment was the first Macedonian studio to participate in the prestigious gaming event in Poland so far.

Zborle.mk

Website: Зборле - МК клон на Wordle (zborle.mk)

Game: This is a "Wordle" Macedonian 'clone' and it is very popular at the moment.

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