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Different markets will be addressed in the ITEA project. BeWell Innovations will focus on the Belgian Market. Woorisoft Inc. & Rhaon Entertainment will focus on the Asian market, and Comland, The Uncomplicated Family and QoC will focus on Canada.

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## 1 Europe

The hotspot of serious game companies in Europe is situated in the Netherlands and compared to 2012, the total number of all game companies has largely increased in the Netherlands. Entertainment game production has almost doubled to a total of 160, taking over applied gaming's previous dominant position. However, serious games are still an important pillar of the Dutch game industry. The total number of applied developers grew by 28% to 158 companies (in 2015). Almost half (44%) of all Dutch game development companies are involved in applied games. Example Dutch serious game companies that also operate in the health domain are: Grendel Games, IJsfontein, Silverfit, &ranj, and MAD Multimedia.

It is noteworthy that most companies have no specific specialization. Almost all companies report that they are working within a range of sectors. There hardly is a difference between the sectors game companies serve. Survey results (Observatory & Koops, 2015) indicate that the main goals of applied games developed in the Netherlands by Dutch game studios are: applied game education, healthcare (training, treatment and prevention combined), closely followed by training of professionals, and awareness creation. Currently, most of the projects completed by applied game studios are driven by client demands. To scale up the applied games market, a more product-based approach, where companies develop games that are applicable and sellable to many clients, is necessary. Some of the more successful and fast-growing applied game studios moving down that path. For example, Grendel Games is turning into a much more IP oriented company. Primarily catering to the healthcare sector, it has developed games such as Underground, a training game and tool for surgeons, and Gryphon Rider, a game and tool for patients with balance issues, that are being sold to hospitals worldwide.

The Dutch government recognizes the applied game sector as a potential growth sector. We see governmental support on several levels. Programs such as ClickNL Games and Growing Games have provided support for both applied and entertainment games. There is also support for scientific research on (primarily applied) games, with the Netherlands Organization for Scientific Research (NWO) being responsible for the bulk of the research funding.

The Dutch Game Association is the biggest association in the Netherlands. They report that the positive worldwide trends are, to some extent, reflected in the developments of the Dutch games ecosystem. The analysis reveals that over 60% of Dutch game companies saw a growth in revenues, with an aggregated turnover of €155-225 million. However, most profits are modest (up to €100,000). Similarities between the Dutch and other European game industries are the small size of companies and a growth of new studios. The Dutch games industry has a heavy focus on applied games and a significantly smaller turnover per employee due to the lack of large and successful studios.

In contrast to the Dutch gaming industry, gaming companies in Belgium have a higher focus on mobile devices (Bogte & Verbruggen, 2016). The serious game industry in Belgium is thus not that big and not that well documented as in the Netherlands. The total funding that was granted to serious games (not related to

learning) was ca. €740,000. However, it is not clear which companies received this funding. Example Belgian companies that have at least one serious game for health in their portfolio are: Triangle-Factory, Sileni, Fishing Cactus, Curious Cats, LuGus Studios, PossiblyPixels.

FLEGA vzw is the biggest association in Flanders and WALGA asbl in Wallonia. They report that the Belgian game revenue amounts to €43 million. However, they mention that some game companies are moving outside Belgium due to the high labor costs. De Flemish game industry is sponsored in different ways. The 'Gamefonds' was originated in 2012 and is coordinated by the 'Vlaams Audiovisueel Fonds (VAF)'. Both serious games as normal games can apply for this funding. For serious games focus on learning there is a budget of 180,000 euros, for all other games (including serious games) a budget of €550,000 is provided (in 2016). However, in 2018 their budget is raised with €1 million, thus more than doubling the funding available for the Belgian gaming industry. The Flemish government also provided incubators throughout Flanders. The first dedicated game incubator is situated in Hogeschool West-Vlaanderen and is called 'The Hive'.

There are no reliable statistics for serious games market size in the Slovenian region. Firstly, it should be noted that it is a geographical region particularly heterogeneous comprising areas as Austria and northern Italy that are close to the European averages in terms of market size. Other countries are significantly less developed in serious gaming industry with only scarce noteworthy production entities.

Only small businesses and research consortia are active in this market. For example total revenue from gaming in Slovenia is only \$32 million (Newzoo, 2017). Businesses and research formations are mainly research-driven and comprise groups of universities, professors, individual researchers and/or research private companies. More often, these enterprises and research groups comprise smaller parts of bigger consortia and synergies and only partially involve in the development of integrated serious-gaming applications. In this respect, we cannot observe specific flagship cases in this region, but only small or bigger consortia which operate in the market. Worth noting is an EU-funded attempt into serious gaming called Ludus Project with its primary objective: *the creation of a South Eastern European network for the transfer of knowledge and dissemination of best practices in the field of Serious Games*, but the project is inactive since 2012.

On the other hand, in this region, there are innovative and promising research oriented and skilled startups (teams of programmers, cartoonists, trainers, advertisers, health-care workers) that, because of the underdeveloped market of serious gaming, focus mainly on the global market. Examples of these gamified health care apps are Austrian start-up <https://mysugr.com/> and Slovene start-up <https://blubblub.org/>.

## 2 Canada

In Canada, the Healthcare and Social Assistance industry sector comprises 2,574 businesses employing 68,074 people, and annual growth is forecast to be 3.5% between 2018-2023 with a potential revenue of \$4 billion ([IBISWorld, 2017](#)). Caregiver services to patients with Autism Spectrum Disorders (ASDs) within this sector are characterized by individuals experiencing challenges with communication, social reciprocity, and structured behaviour. As of 2016, 520,000 individuals in Canada who live on the autism spectrum represented only 1.5% of the population, but costly health-care, educational and social services range from \$1.4 to \$1.8 billion CDN to support a single generation of individuals with ASD ([The Entertainment Software Association, 2017](#)). ASD has increased over 100% in the last 10 years, and in the United States, the Centers for Disease Control and Prevention estimate autism's prevalence as 1 in 42 boys and 1 in 189 girls. With 1 in 68 children currently diagnosed, it is now the fastest growing and most commonly diagnosed neurological disorder ([Autism Speaks Canada, 2017](#)).

The broader interactive digital media (IDM) sector includes companies producing interactive content and those supporting this enterprise. Although not exhaustive, IDM companies produce digital content for video games, cross-platform entertainment, virtual and augmented reality, web series, e-learning and training products. Content is offered via several digital platforms, such as PCs, mobile devices and game consoles. In the United States, 53% of the most frequent gamers play multiplayer games at least once a week for entertainment, spending an average of 6 hours playing with others online and 5 hours playing with others in person ([The Entertainment Software Association, 2017](#)).

Gaming, as a sub-sector of the interactive digital media industry, accounts for nearly \$2 billion in Canadian economic activity, ranking third behind the U.S. and Japan ([Canadian Interactive Alliance / L 'Alliance Interactive Canadienne, 2012](#)). Canada has some of the world's largest, fastest growing and award-winning video game studios, albeit directed mainly towards entertainment. The preponderance of the industry data in 2017 emanates from eastern Canada and British Columbia (BC), given the higher proportion of video game studios in those provinces (Québec=198; Ontario=171, BC=152) compared to the rest of Canada combined (=75). In 2015, it was estimated that Ontario's IDM industry contributed \$1.4 billion to the provincial GDP and \$1.27 billion in revenue ([Canadian Interactive Alliance / L 'Alliance Interactive Canadienne, 2012](#)).

There is a paucity of research data for the markets of serious games, games for health, and gamified health apps specific to autism, especially when targeting even more specialized domains such as language. However, some educational software products designed to support children on the autism spectrum, and their families, are available and marketed through giants, such as Apple iTunes and Microsoft. Although not specific to Canada, games developed across genres (e.g., action, role play, simulation, strategy) and those using social media sites to play games, such as Facebook and Reddit, are predicted to increasingly attract customers and foster market growth ([Grand View Research, 2018](#)). A 2017 study surveying Canadian companies engaged in developing VR products and services found that 86% of respondents predicted VR would be a mainstream medium by 2021 ([Canadian Film](#)

Centre Media Lab, 2017). Most companies currently engaged in the VR landscape, however, reported their VR offerings as only one business stream. Future VR use cases were anticipated to be highest in the K-12 Education sector, which could result in positive implications for schools seeking innovative strategies and resources to support autistic children within their circles of care (Canadian Film Centre Media Lab, 2017).

The Canadian Autism Spectrum Disorders Alliance (CASDA) is a coalition of organizations and individuals developing a comprehensive National ASD Framework working with federal government ministries, such as Public Health Agency of Canada (PHAC), Health Canada (HC), and the Canadian Institute of Health Research (CIHR). Other relevant agencies are National Research Council (NRC), Ontario Centres of Excellence, and University of Waterloo Games Institute.

Autism Speaks Canada and Autism Canada are two other prominent national organizations that partner with the government for special projects related to autism (e.g., Canadian Autism Partnership Project). Access to the clinical, educational and game development community is available via membership affiliations, such as the Serious Game Association, Education International, Speech-Language and Audiology Canada. Access to families and caregivers is available through social media marketing and other associations, such as the American Speech and Hearing Association, Alzheimer's Association, and the Finnish Association for Autism and Asperger's Syndrome.

An organization the consortium may wish to connect with from a technological perspective is the International Game Developers Association, which is a large nonprofit membership organization for individuals creating video games who are interested in connecting with other members and peers, advocating for issues in the developer community, and promoting professional development within a growing gaming industry.

In 2017, Canada was predicted to spend about \$723 million on augmented reality (AR) and virtual reality (VR), according to the International Data Corporation's Augmented and Virtual Reality Spending Guide (International Data Corporation, 2017). VR content revenue is predicted to be divided primarily between video games and apps and generate \$15.1 billion within the next five years. PwC anticipates the number of headset units sold to reach 257 million by 2021, emphasizing that portable units designed to work with smartphones and high-end headsets for use in the home (such as Oculus, HTC and Valve and Playstation's PSVR) will drive content revenues. This market is still deemed immature with underdeveloped business models; however, monetization models have surfaced for interactive digital media in parallel with the growth of new technologies and platforms. Experimental proliferations of approaches by early adopters reflect consumer-paid, funded, and hybrid models, as outlined in the table below adapted from the Canadian Interactive Alliance / L'Alliance Interactive Canadienne (CIAIC), a not-for-profit trade association formed in 2005 to serve as the voice of Canada's interactive digital media industry:

Table 1. Typical business models.

<b>Consumer-Paid Models</b>	<b>Funded Models</b>	<b>Hybrid Models</b>
Subscription Transaction Metered (a.k.a. Paywall) Premium Merchandising	Ad-supported (e.g., banner, video) Branded Content Licensing	Freemium (but with premium charged for advanced features) Paidmium
<p>Adapted from CIAIC, <i>Monetizing Digital Media: Trends, Key Insights and Strategies that Work</i> (November 2014, pp. 5-6); <a href="https://trends.cmf-fmc.ca/media/uploads/reports/monetizing-digital-media-0115.pdf">https://trends.cmf-fmc.ca/media/uploads/reports/monetizing-digital-media-0115.pdf</a></p>		

### 3 South Korea

The serious market is segmented according to domain, specific tools and game platforms. In South Korea and Asia, the markets are growing rapidly with health and education domain. According to the report of KOCCA (Korea Creative Content Agency) in 2014 (korea creative content agency, 2012), 250 games have been deployed to the market by about 200 companies.

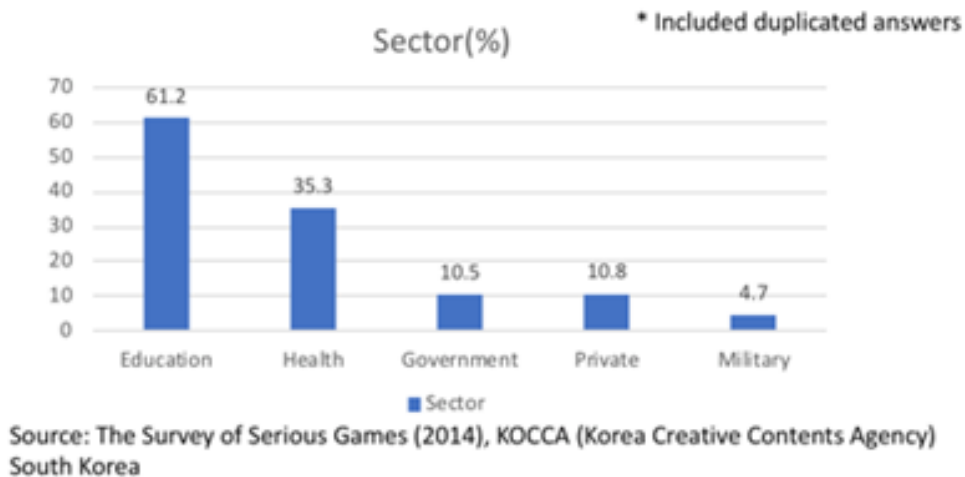


Figure 1: Total market volume of serious games in South Korea. Sales: 32,279,000,000 KRW (ca. €24 million) for in total 189 companies

Most serious games used were found to be used in mobile and online platforms. Education, Hospital and government agency are the three main sectors of serious games in Korea. The demand of Health games is expected to increase both in private and government sectors.

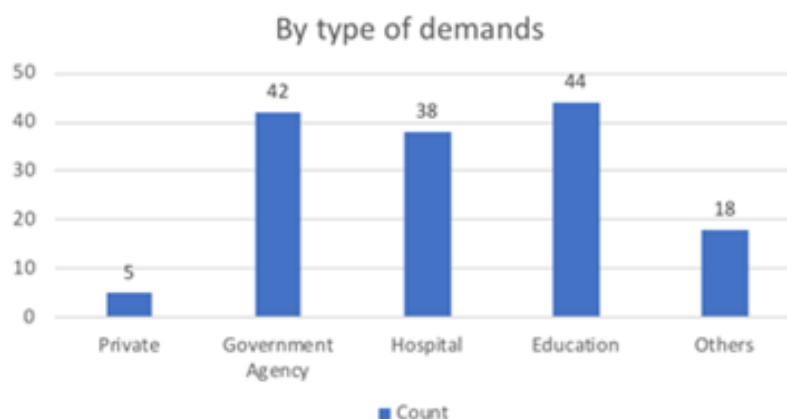


Figure 2. Classification of 120 organizations using serious games

In South Korea, there are two government organizations involved in health game industry. The first is the Ministry of Healthcare and Welfare, which come up with

health regulation and plan, and the second is the Ministry of Culture, Sports and Tourism, which supports game-related R&D program. The MCST (Ministry of Culture, Sports and Tourism) established a game agency, KOCCA (Korea Creative Content Agency), in 1999 to promote the game industry and they invested \$3 million in Serious Game development in 2017 (KOCCA, 2018). The KOCCA funded about 50 serious games development including sports, learning, entertainment and health field since 2012.

South Korea has 20,000 children with developmental disorders across the nation (Statistics Korea, 2017). This number is high and growing, so South Korea's first hospital dedicated for children with developmental disorders was opened recently in Seoul. This is done by Samsung Group and the first action cooperate with public and private sector. In Korea, developmental disorder is not fully covered by the national health insurance system, so many private clinics and hospitals develop and operate rehabilitation programs. This is good opportunity for those kinds of private companies who have cognitive training programs and solutions. Therefore, South Korea rehabilitation hospital and clinics have stated to introduce computer-aided cognitive rehabilitation training system from 2010. This system is a software program installed personal computer with specially designed input panel or mouse. The two or three computer-based cognitive training systems such as Hasomed Rehacom, CoTras, COMCOG dominate the market in our region.

According to ComCog web page (<http://www.neofect.com>), they defined computerized cognitive rehabilitation as "helps people with stroke, dementia, traumatic brain injury, brain tumors cerebral palsy so that they can benefit from brain activation and dementia prevention".

The game industry currently uses several business models such as Freemium and Premium models through App Stores, but the typical business model for serious games is a direct-sales to government agency and hospitals as a package software.

#### Direct sales

- This is a paid model and the typical business model in our region and the client buys cognitive training system and pays the product bill to development or sales company.
- The product is package software, server and client system, and stand-alone system.
- A service company bill client for maintenance by year.

#### Freemium and subscription

- The App development company uploads their cognitive training application on the App Store
- A user uses application with limited features free of charge
- A user can purchase a full version by In-App purchase and developer get paid according to the agreement with the App Store



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