with games regarding graphical presentation. However, the demos were not interactive. Demos were often technical achievements that demonstrated artistic creativity that pushed the boundaries of computer graphics.

The demos were often created by collaborations within different groups. The often international demogroups, consisting mostly of young males, would try to outshine each other with spectacular demos. Demos would be shown and spread at computer meetings and through BBS-servers (Polgár 2005).

One early company that sprung directly out of the demoscene was Digital Illusions (DICE). Some Swedish members of the demogroup "The Silent" started working on a pinball game in the late 1980s. As a consequence of a contract with British publisher 21st Century Entertainment, a company was founded in the beginning of the 1990s. The company developed a few pinball games (*Pinball Dreams*, *Pinball Fantasies* and *Pinball Illusions*) before deciding that the market for pinball games was too small. The company moved over to the broader racing genre in order to expand.

DICE got more solid financial backing in the middle of the 1990s. Bonnier, one of the largest book publishers in Sweden, wanted to get into the game industry and invested in the company. The new capital made it possible for DICE to expand into other genres once again. This time, DICE expanded by buying up a number of smaller companies, the most important acquisition being the Swedish company Refraction Games. Refraction had released the first-person shooter (FPS) game *Codename Eagle* in 1999. *Codename Eagle* was an innovative game, but did not become a big commercial success. Refraction had planned a follow-up game, later known as *Battlefield 1942*.

Another of the early companies with a similar background and its roots in the 1980s was Atod. The company has not developed any well-known hit games and it has grown neither as quickly nor to the same extent as DICE. Atod started developing games for the ZX Spectrum before moving over to Commodore Amiga in the early 1990s. In the mid-1990s the company moved over to console games, which was unique in Sweden, almost all other companies were oriented toward the PC market.

The Swedish game industry was in an introduction phase and expanded slowly until the second part of 1990s. DICE and Atod were among the few developers that were established in this early phase and managed to survive into the 2000s. When the expansive period began, the number of new companies increased rapidly during a period of just a few years. The number of active companies rose from under fifteen companies in the mid-1990s to over eighty in 2002. This increase coincided with a growing interest in the ICT sector in general. Many of the most influential Swedish game studios were founded during this period. Starbreeze, Avalanche Studios, Massive Entertainment and Mindark are some of the game studios that started during this period.

One of these companies, Starbreeze, was established in 1998 and now belongs to the most recognized game studios in Sweden. The company

was formed when individuals from the demogroup Triton got a contract to develop a 3-D fantasy game called *Sorcery*. Like most Swedish developers, the company was focused on the PC market and developed their own game engine. The fairly inexperienced development team had a very high level of technological expertise, but nevertheless experienced problems finishing the programming of the game. In 2000 the French publisher Infogrames bought the British publisher Gremlin Interactive and decided to terminate the game contract. The game was far from being finished and no new publisher took over the contract. The loss of the contract seriously threatened the continued existence of the firm (Sandqvist 2010, 170). Not only Starbreeze, but also the industry as a whole was about to change.

THE TRANSFORMATION, 2001–2005

In the early 2000s the game industry was hit by the general decline in the ICT-sector after the dot-com bubble burst. An increasing amount of game studios disappeared or were reconstructed. From 2003, the number of companies in the game developing industry became unstable.

The most spectacular change was that two of the largest and most influential companies at the time, Daydream and Unique Development Studios (UDS), closed down in 2002. The two companies had been bought by venture capitalists. When the game companies did not show any profit the owners filed for bankruptcy. UDS was at the time the largest developer in Sweden and had over seventy-five employees, which was about 14 per cent of the total workforce. Daydream was a smaller company but was well

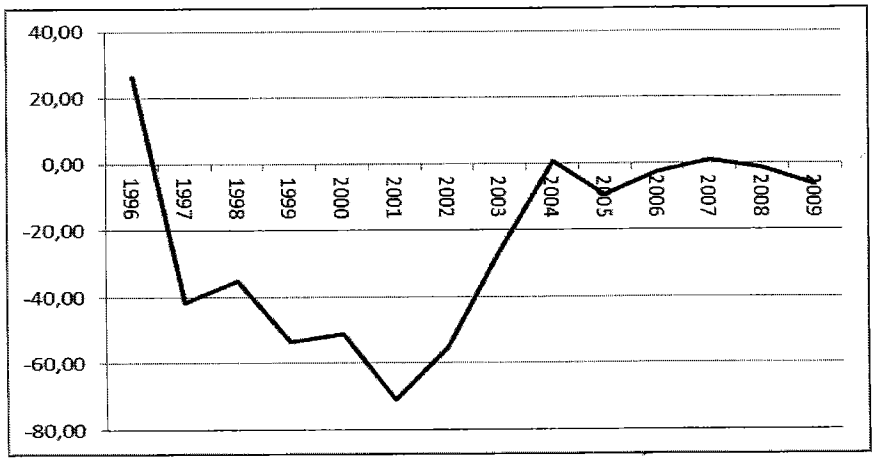

Figure 7.1 Return on equity within the Swedish game industry, 1996–2009. Source: Data compiled from the annual reports of all Swedish game developing stock companies.

known in Sweden and had become the first publicly traded company in the Nordic countries (Daydream 1997).

The Swedish game development industry has never generated any large profits, but during the millennium shift the losses became alarmingly high. Looking at the return on equity in Figure 7.1, the problem within the game industry becomes clear: the return rates are strongly negative. The years before and after the IT bubble burst, the industry was bleeding money and the result was particularly low between 1997 and 2003. During this period a lot of money was invested into game projects that never yielded any profit. Subsequently tens of millions of euros had to be poured into the companies to cover the losses.

The industry went through a transformations phase after 2001. This phase can also be seen in the number of employees working within the industry (Figure 7.2). There was a decline in the number of employees 2002 and 2003, when around 22 per cent of the workforce disappeared from the industry. The industry went from close to six hundred people in 2001 to 450 in 2003. The reason for this was not only that a couple of the largest companies went out of business, but also that a number of companies downsized during these years.

Even through the fast industry expansion, the percentage of women working at game developing companies has been low and even declining. There had always been significantly more men than women in the industry, but the gender distribution got even worse during the years with decline (Figure 7.2). During the transformation period the share fell even more, down to around 7 per cent in 2002 and 2003. This indicates that women

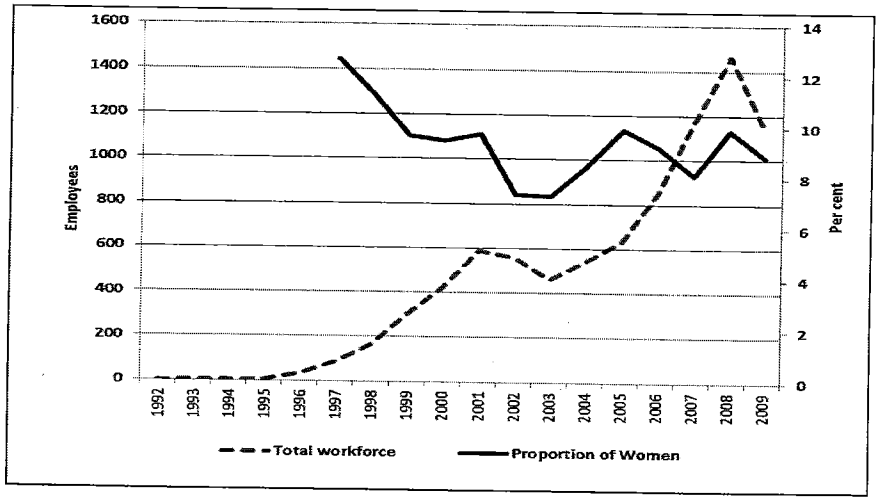

Figure 7.2 Total workforce and proportion of Women within the Swedish game industry, 1992–2009. Source: Data compiled from the annual reports of all Swedish game developing stock companies.

are not among the core group or not viewed as core competence within the company and therefore will be cut first. New companies tend to have a very few women employed, if any at all. There seems to be a horizontal segregation within the industry and many of female employees work outside production, with support functions like finance or public relations (Sandqvist 2010, 215).

The big changes within the industry, between 2001 and 2003, also came through some major acquisitions and reconstructions. Starbreeze had gotten into financial problems after losing their first developing contract and O3 Games, another Swedish developer, bought Starbreeze and merged the two companies. The new company developed a few games, but continued to have problems with publishers cancelling projects. After the game *Enclave* was released in 2002 the German publisher Swift went bankrupt and Starbreeze had to lay off staff.

The problems that Starbreeze faced also had other effects within the industry. Starbreeze had entered a contract to buy the Swedish company Rock Solid, but broke the agreement and Rock Solid was forced into bankruptcy. A settlement was later negotiated between Starbreeze and the proprietors of Rock Solid (Starbreeze 2004). The owners of Rock Solid later started up Avalanche Studios, which came to develop the *Just Cause* series and became one of the largest developing studios in Sweden.

Starbreeze also sold parts of the company. Starbreeze slimmed down the organization by reducing the animation and motion capture department. This part of the company was sold to the British company Centroid (Starbreeze 2005). The new specialized studio has since worked with many of the larger game productions with motion capture and animations, technologies that most Swedish companies no longer keep internally.

The success for Starbreeze came with *The Chronicles of Riddick: Escape from Butcher Bay* for Xbox in 2004. The game was critically acclaimed but was not the economic success it could have been. The Xbox console had a limited diffusion and the PlayStation 2 version of the game had been cancelled. The game was highly innovative and was one of the first games that used normal mapping, a technique that can output highly detailed environments while reducing the number of necessary polygons. The technique opened up an advancement in game graphics and became a widely used standard. Support for normal mapping is built into modern game consoles.

During this period, the older company Atod was thrown into a spiral of acquisitions by foreign publishers. First Atod was merged with the British company Warthog, who bought the company in 2002. It later became Gizmondo Sweden, and after financial difficulties it ended up as a part of the British publisher Eidos Interactive in 2006, after which it became Eidos Studios Sweden. Another large acquisition was the French publisher Vivendi Universal, who bought strategy game developer Massive Entertainment in 2002.

The most dramatic acquisition was of the largest Swedish company DICE. The company had released the success game *Battlefield 1942* in 2002. The

game was unique within the Swedish industry because DICE was able to keep the IP rights to the game. Publishing companies will demand the intellectual rights to games in exchange for the investment. Very few Swedish companies have had the financial capacity to keep the rights in negotiations with publishers. Ultimately this means that they lose the possibility for high revenues in the future if a franchise becomes successful.

Owning the *Battlefield* franchise, DICE seems to have been launched into a series of events leading up to a takeover. The American publisher Electronic Arts (EA) had published *Battlefield 1942* and started pursuing DICE and the franchise. DICE was publicly traded and EA bought 19 per cent of the shares in 2003. This must have made a takeover almost inevitable; EA holding shares must have limited the possibilities for DICE to sign new deals or even cooperate with other publishers. In 2004 EA put a bid on all the remaining shares in the company. Many of the minority owners did not accept the bid. The Swedish Shareholders' Association, which represents many shareholders, recommended not accepting the bid.[5] They stated that DICE was worth much more than the offered bid. In the end, EA only got 68 per cent of the shares, far from the 90 per cent required by Swedish law for a takeover, and was not able to buy out the minority owners. EA then used a loophole in the Swedish fusion regulation. To force a fusion between two companies only two-thirds of the shares were required. This was one of a couple of cases in the beginning of 2000 that led to changes in the Swedish law concerning corporate fusions (Ds 2007:35). DICE went through a fusion with an EA subsidiary in Sweden and was from 2005 entirely owed by EA.

THE APP FACTORY AND FINANCIAL CRISIS, 2005–PRESENT

The composition of the Swedish game industry has changed in recent years. The number of companies has steadily increased, and in 2009 there are about 110 game developing companies. Additionally roughly forty game developing companies are sole proprietorships or general partnerships. The composition of companies have changed, there are four larger companies with over one hundred employees (Digital Illusions, Starbreeze, Massive Entertainment, Avalanche Studios), but the majority are today very small and have only a few employees.

After the decline in 2003–2004, the industry bounced back quickly (Figure 7.2). The number of people working in the industry started to increase again at a very high rate. The industry continued on an exponential growth trajectory. The industry grew from the lowest point in 2003 with just over 450 employees to nearly fifteen hundred people in 2008. Old companies absorbed people from the liquidated companies and many new companies emerged. A clear example of this would be the provincial town of Umeå; there a whole cluster of companies arose from the ruins of Daydream, the

largest and most successful is Coldwood Interactive. Coldwood developed mostly sport games and is probably best known for *The Fight—Lights Out* from 2010, one of the release titles for the PlayStation Move controllers.

The rapid technological progress was responsible for parts of this development and opened up whole new markets and possibilities. Swedish studios had up until the 2000s mostly focused on PC games, and only a few created console games. PC development was a free and an open technology that did not require any license, but the downside is a much smaller market (DTI 2002). In recent years the larger companies have focused more on console games, but the largest change has come from the development in handheld gaming. Many of the companies established in recent years are oriented towards the development of games for mobile platforms and smaller downloadable games. The rapid development towards standardization within hardware, software and distribution seems to have attracted many new developers. The Apple iPhone, IOS operating system and App Store are prime examples of this new mobile infrastructure. Digital distribution in general seems to have helped developers by circumventing the distributions functions that publishers traditionally have.

To some degree, the new Swedish companies share similarities with prior game developers—they are most often composed of young men with exceptional computers skills—but in other ways they are more heterogeneous. They have, for example, very different strategies regarding firm structure and the financing of their projects. Some of these developers have been successful and are well known within the game community. A handful of Swedish indie developers have competed at and won the annual competition at the Independent Game Festival (IGF).

Best known and most successful is the company Mojang and its creator Markus Persson (aka Notch) with the acclaimed game *Minecraft*. The game has to date sold four million copies, making it one of the best-selling Swedish games ever.[6] The game is limited in graphical scope but excels in the open, inviting and creative sandbox gameplay. Mojang distributed the game and went outside the conventional distributions channels and traditional marketing. The company also used an unconventional financing method by making the game available for purchase during the development phase.

Another successful small-scale developer is Frictional Games, focusing on downloadable PC games that are somewhat more limited in scope compared to big-budget titles. Frictional Games made the game *Amnesia*. The game won awards at the IGF and was partly financed by grants from the Nordic council (a council formed in 1952 with elected members from Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland and Åland). The Nordic countries support a couple of developers each year with grants, but the total amount is relatively small—annually around eight hundred thousand euros.[7] Another of the Swedish IGF winners is Erik Svedäng, who won in 2009 with the PC game *Blueberry Garden*. He has

recently created a couple of apps for Apple iOS, for example, the iPad game *Shot Shot Shoot*.

Other famous developers like Jonatan Söderström (aka Cactus) and Nicklas Nygren (aka Nifflas) have chosen to go outside the traditional industry patterns and release many of their games as free downloads. The result of this is no direct capital income from these games; it instead leads to quite a build-up of cultural capital, with fame and a huge following. They finance the development by taking other jobs or by utilizing the Swedish welfare state, for example, by taking the general available government university student grants and loans.

Although new companies have been introduced the last couple of years, there has been some turbulence within the industry. The financial crisis in 2008 hit the game industry hard, and the situation in Sweden was similar to the dot-com bubble burst, but without the structural problems. The economic results in the Swedish industry were not as alarming; the return on equity (Figure 7.1) was 0 per cent in 2007, but far from the extremely low levels of the period 1997–2003. The economic fundamentals were better, but again, some of the major players disappeared or reduced the workforce.

The most spectacular bankruptcy was the fall of Grin in 2009. Grin was one of the companies that had turned a good profit and was, in 2008, the second largest developer in Sweden. Grin had even expanded abroad, and with 140 employees in Sweden, the company had almost 10 per cent of the total industry workforce. Consequently, the bankruptcy had a profound effect on the structure of the industry. The company was founded in 2000 and had developed a game engine used for the PC adaptations of *Ghost Recon*. Grin was one of the first Swedish companies that got a contract with a Japanese publisher. Grin developed the new games in the *Bionic Commando* series for Japanese publisher Capcom. Grin encountered problems in 2008. The company had a new contract with Square Enix, one of the other major Japanese publishers, to develop a new *Final Fantasy* game. Grin had expected a large payment that was contested and ultimately not paid, and the company was in rapid succession forced into bankruptcy. In the aftermath of the Grin bankruptcy a large number of new companies were established by former employees (Ottsjö 2011).

Avalanche Studios, the creators of the *Just Cause* games, was also hit when the company lost a contract when publishers became more restrictive with game contracts after the financial crisis. Avalanche did not go broke but had to let people go and a planned expansion had to be put on ice.

THE COMPANY STRUCTURE AND NEW INDUSTRY ORGANIZATION

There are a few large companies within the Swedish industry. These companies expanded rapidly, from only a few employees and a loose structure

in the 1990s to larger and more professional multidivisional firms in the 2000s. One of the driving forces behind this could be linked to the technological development. The industry has faced a spectacular change in technology connected to the continued fulfilment of Moore's law. Games are one of the kinds of software that really push the limits of the law. Few other consumer programs will use so much processing power and storage capacity as games, and this will by itself create a demand for faster computers. The companies have had to transform through expansion and specialization to be able to follow and explore the new technical possibilities.

There seems to be a tendency towards increased market coordination (modularity) within the industry (Baldwin 2008; Hoetker 2006; Langlois 2003, 377–378). There seems to be two different developing tendencies within the Swedish industry.

The *first* is that game developers can choose to buy middleware modules available on the market, such as game engines or physics engines. These modules have become more advanced with the rapid technical development.

Larger Swedish companies have historically invested in their own technology for example own game engines. Two examples are DICE, who has the Frostbite engine, and Starbreeze with its Starbreeze engine. Both have had around fifteen people that develop and adjust the engine for every different game. This is a cost that few companies can justify and it is not likely that newly established game developers have the resources to develop a new modern game engine or do similar technical investments. Even the bigger companies have problems keeping up with the development. DICE has, for example, used the Unreal engine 3 from Epic for the game *Mirrors Edge*, because it was too time consuming to adjust the engine to all their different games. Starbreeze will use the Unreal engine for a future game project (Starbreeze 2011).

The *second* tendency is the possibility to buy production capacity through outsourcing, especially concerning graphics. Specialized companies within Sweden, but also in low-wage countries in Eastern Europe and Asia, offer services directed towards the game industry. Game developers have, for instance, the possibility of ordering a bulk of 3-D objects from these companies. An example of this is Swedish companies who are offering motion capture facilities. The motion capture technology has evolved rapidly during the last ten years and it is no longer rational for every company to have their own facility. Game developers will also outsource parts of their game development. Looking closely through the credit list of *Battlefield Bad Company 2* one can see that DICE, for example, hired Coldwood to work on some part of the game.

The two tendencies, buying middleware and outsourcing, make it somewhat difficult to follow the game development industry over time. Production moves from the game developing companies into new subsectors within the industry. New types of companies have emerged within Sweden, but it seems likely that Swedish game developers will use the products and