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Path creation in the software industry – The case of the Software AG

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Abstract: The article analyzes the development of the German software company Software AG, which was among the few European companies that succeeded in the US market already in the 1970s. Utilizing the concept of "path creation" it examines how early success impacted the development of the company. It shows that at least two paths in the development, the focus on the ADABAS product ecosystem and the underlying technology as well as the strong internationalization, relate to the early success and influenced the further evolution of it. The analyses reveal that they played an important role in how the company reacted on the rise of relational databases and the vertical disintegration of the computer industry. As a consequence of the late adoption of them they company got into troubles and needed adjust their profile and orientation during the 1990s and early 2000s, which is analyzed in the final part of the article.

Nowadays it seems natural that young software and IT startups can become international players within a few years of existence, but this was different in the early years of the software industry. Normally new founded companies operated in their home markets and it took considerable time before they started to internationalize. But as stated by Martin Campbell-Kelly in his history of the software industry, there was one exception from this pattern. Already in the 1970s there was one German software company, which had considerable success as an independent software product company in the United States.[1] The company, called Software AG, was located in Darmstadt, in the middle of Western Germany. The early success of the company continued as the company was in 1985 listed at position 13 among the 15 leading independent software product companies in the US. Already in 1981 they were listed as number one of the independent European software product companies. And in 1989, the year where the company celebrated its 20th anniversary, the company was by far the biggest software company in Germany with sales significantly higher as SAP AG, the second biggest company at that time.[2] But only a few years later the situation had changed. While SAP became a world leading software product company, the growth of Software AG stagnated and the management had to deal with severe issues. Altogether, this development raises several questions: How was it possible that the company entered the American market so early? Why did they succeed in this market? How did this success affect the development of the company in the future? Why does the growth stagnate in the early 1990s?

To answer these questions the article will use the concept of path creation developed by Garud et al. in the last decade.[3] It refers to the concept of path dependency, which is well known in the history of technology and business. It was initially developed through the seminal works of Arthur and David and describes how previous decisions influence further decision and thereby leads to a stable path of development, the so-called path dependency. One important aspect of it is that a stable path can lead to "lock-in" effects, which makes it nearly impossible to leave it.[4] Normally, it is understood as a process with different phases, where the passage from phase to phase is triggered by different kind of events and the overall process is according to Arthur driven by self-reinforcing mechanisms such as the principle of increasing return and positive feedback. Most notably is the assumption that once a "lock in" is reached, it can be only broken up by exogenous shocks.[5] The concept was taken up in several other areas such as organizational studies, economics or political sciences.[6] Accordingly, the concept experienced several expansions and interpretations and Beyer for example identifies at least seven self re-enforcing mechanisms used such as increasing returns, sequences, functionality, complementarity, power, legitimacy and conformity.[7] In recent years newer management research raised attention for the role of the actors and their agencies instead of contingencies and exogenous events. This led to a development from path dependency towards the concept of path creation, which takes actors and their agencies more into account. Addressing the issues of the complexity of emerging systems and shifting the focus away from contingency and exogenous shocks, where actors only react, Garud et al. conceptualize a distributed and emergent agency that arises through the interaction of actors and artifacts. As a consequence, their concept of path creation defines central aspects differently. In their point of view initial conditions are flexibly defined and constructed in negotiations among the actors, who have different time frames and different prior or future expectations that they use in different ways. Similar, contingencies are not random events for them. Instead the actors are aware of the possibility that future events will differ from expectations, which leads to the necessity to improvise in order to deal with these emergent situations. Additionally, they also argue that self-reinforcing effects are not only structural or exogenous given, but instead that actors can purposively initiate actions to enforce developments leading to such effects. Above that, they also state that self re-enforcing effects also can initiate structurational processes. With regards to the lock in, Garud et al. define it rather as provisional stabilization in a broader structurational process. By this they emphasize the fact that actors are not only passive reactors to such processes as well as the fact that the differentiation between contingency and exogenous shock is stressed if time frames are changed.[8] It is based on the

structuration theory of Giddens, which seeks to dissolve the classical dualism between actor and structure.[9] Additionally, it is inspired by the concept of sense making by Weick[10] as well as the actor network theory (ANT), developed by Latour, Callon and Law. In particular the focus on agencies of actors and artifacts is inspired by different concepts in ANT such as translation or the generalized symmetry.[11]

Against this theoretical background and based on interviews, archival material from the company, in particular annual reports and customer magazines, as well as contemporary secondary material, the article searches to analyze the development of Software AG from the beginning until the early 2000s, which are divided into different phases. They cover the difficult beginning, the early success in the US, the growth and development of the company afterwards as well as the crisis in the early 1990s and the responses to it. The analysis focuses on technological, economical and organizational decisions within Software AG as well as the related developments outside of it. In the course of that, the article will analyze the initial conditions, processes and events, self-reinforcing mechanisms and will discuss which exogenous influences and internal agencies can be found and how they impacted. Overall, the aim is to analyze how the development of the Software AG was influenced by previous decisions, contingencies or agencies and how this impacted the company throughout time.

Foundation and early years of the Software AG, 1969-1974

During the 1950s and 1960s Darmstadt, where Software AG is located, was one of the centers for computer technology in the Federal Republic of Germany. At the Technical University Alwin Walther built in the 1950s one of the first computers in Germany, called DERA (Darmstädter Elektronischer Rechenautomat). He also hosted the first international conference on programming in 1955.[12] During the 1960s the university enlarged their activities and started to offer one of the first programs for computer sciences and programming in Germany.[13] Additionally, the Deutsches Rechenzentrum (German data processing center), as one of the first public research centers for a computer science was established in 1964.[14] All in all these developments led to the creation of an environment, where a growing number of educated programmers existed.

The foundation of Software AG

Given this it is no surprise that a number of smaller computer consultancies started in Darmstadt. One of them was the Institut für Angewandte Informationsverarbeitung (AIV, Institute for applied information processing), founded by Peter Kreis. During the time several spin-offs emerged from it and among them was a company called Software AG, which was founded in 1969 by six employees and partners of the AIV.[15] Though this sounds like a normal process in an evolving industry, there are two facts that need to be mentioned. Firstly, the fact that the company was actually founded as a stock company, which was remarkable because a capital stock of one million DM was needed in order to make that step. Secondly, the fact that the aim of the company was to sell or license software products, which was something that no other company in the German software market was doing consistently at that time. Given the fact that at this time software development was not a reasonable business case for German banks and that venture capital did not exist in Germany, the solution for the funding problem was rather creative. In order to raise the one million DM needed for a stock company, they used several programs developed during the time at AIV as company assets. These programs were valued at 994,000 DM by an auditor, leaving only 6,000 DM to be contributed in cash. Among the people raising that money were Peter Kreis, the owner of AIV, and Tilo Strickstock, a longtime member of the executive board, as well as Peter Schnell, who was a long-serving CEO of the company. Nevertheless, the business with software products transferred from AIV and then further or fully developed went quite poorly in the beginning. As a consequence, the founders of the Software AG had to act against the goals of its own business model and support itself by offering programming services. A first step towards a product based company was achieved when a first version of the database system ADABAS (Adaptable Database System), one of the original assets of the company, was installed at the Westdeutsche Landesbank in 1971. It was developed by Peter Schnell and his colleagues based on experiences they had made in various customer projects at AIV and later at Software AG.[16]

ADABAS was a database management system that had in comparison to the then most commonly used hierarchically organized database systems at that time advantages by utilizing a special form of relational database models, the so-called *non-first-normal-form* (NF^2). It was superior to the existing hierarchical systems in terms of performance as well as simpler to handle for maintenance, but the relational database model published in 1970 and developed throughout the 1970s by Codd was only implemented to a limited extent.[17] Though this was a first success, the situation in 1971/72 was critical considering the low number of sales and licenses and the need to accept programming service contracts, only a cut of the company's capital and a subsequent reorganization, with Peter

Kreis advancing into the supervisory board and Schnell and Strickstock now representing the executive board, could guarantee the company's survival.[18]

But only a few years after this crisis, at the beginning of 1975, Software AG was honored in a way, which shed new light on the whole situation. During the newspaper IPC Quarterly's million dollar dinner, altogether 19 program (packets) were awarded that had made more than $5 million in sales since they were published. Among those were three with more than $20 million and two with more than $10 million. Of the remaining 14 that had exceeded $5 million, the only non-American company was Software AG with ADABAS. In Germany, the number of programs that had exceeded one million DM (then worth around $400,000) in sales was assumed to be less than 10 at the time.[19]

The creation of the Software AG of North America

The origins of this development can be traced back to Peter Schnell's encounter with John Maguire in 1971 on an American trade fair in Frankfurt. John Maguire was there as a representative of an American software company called CACI that offered diverse applications for companies and wanted to expand to Europe. During this meeting John Maguire learned about the database ADABAS and met its developer Peter Schnell with whom he had a good mutual understanding from the beginning.[20] One reason was that Maguire recognized Peter Schnell's achievements and the potential this database could have on the American market: *„We were at a meeting one day [at Travelers Insurance in Hartford, CT] and one guy asked me how many hundred man-years did this take to write, and the truth was it was only five or six brilliant man-years. Man-years talent-wise goes from five hundred to one.“[21]* But on the other side Schnell also recognized the abilities of Maguire as a communication and sales man, which was the basis for the good relationship. What followed in detail is not clear, but they stayed in contact via mail and postcards during the next months. At the end John Maguire left CACI and received from Schnell, who was at that time the head of executive board, the sole right of representation for ADABAS on the American market. In the spring of 1972, the Software AG of North America (SAGNA) was founded for this purpose.[22] With a new pricing system as well as with marketing, Maguire, who was described by others but also by himself as a "salesman", managed quickly find the first customers: *„I was always a value pricing guy and I had people balk at the $120,000 price and so I got out my Grant's engineering book and a slide rule and I devised all of these lease plans and credits. It was a masterpiece. I did it in a weekend and that changed the business. I was using interest rates between 20- 23% and a guy*

that could approve $2,500 a month in his budget said, I want a five year lease. I took it, thinking I'll worry about it at the end of the five years. And they were selling this was 1973-1975. It was a mini-recession and I devised the lease plan in a weekend at home."[23] And so, ADABAS made total revenue of more than $5 million on the American market in the course of three years, while sales in Germany fell behind in spite of several prestigious customers.[24]

The reason for the American market having been so promising for database applications was that in the 1960s business applications focused more and more on a automatizing routine jobs using computers. One example is the growing number of applications for online transaction processing (OLTP). This was enabled by two complementing developments in hard- and software. One was the development of random access for data storage, which made it easier to manage bigger data volumes. This was complemented by the development of database management systems (DBMS). Until that database systems like the one created during the SAGE project by SDC were simple, almost rudimentary systems, mostly depending on simple text file systems not able to manage bigger volumes. Influenced by the evolution of file management systems (FMS), which were created during the 1960s to support operating systems and/or applications in order to organize and manage files, new versions of DBMS were developed. These made it possible to organize and manage not only files but also particular data. With this, the access and retrieval of datasets was significantly simplified and more manageable. Shortly thereafter, initial products emerged that were specialized on this and called DBMS.[25] Some early examples were the IMS by IBM, IDS by General Electric, MARK IV by Informatics or IDMS, created by Goodrich and sold by Cullinane since 1973, which became in the late 1970s the most installed system worldwide. At the same time, the market for FMS, DBMS and a few other tools for supporting programming created an initial, yet very limited market for software products. This also played a significant role in the unbundling decision of IBM since, faced with an imminent lawsuit by the US government; IBM took the civil law suit with ADR, which was another independent software company, on grounds of possible discrimination in 1969 very seriously. To prevent an escalation of the lawsuit by the government through an inclusion of these points, IBM decided to execute the unbundling they had considered for quite a while on short notice in the summer of 1969.[26] This created another momentum for the growth of an independent software product market as well as for the development of database systems. Examples for the latter are the creation of a task force for databases within the Committee on Data Systems Languages (CODASYL) or the development of the theory of relational databases by Edgar F. Codd at IBM that would go on to fundamentally change the technology and market on

databases. All in all, it is evident that in 1973-74, the market for DBMS in the US began to go from its early stages to a first wave of diffusion.[27] Thus, timing for the Software AG's market entry in America with ADABAS was perfect, especially since it had a competitive advantage because of its performance. The number of customers rose quickly, and, already in 1974, two user conferences were hosted in New York and in Reston.

The first years of the Software AG showed a broad variety of heights and downs for a young company, which are also interesting in relation to the theory of path creation. Mainly two particular aspects, the initial conditions and the contingency of events, are addressed. According to Garud et al. *"initial conditions are not given, but flexibly defined and constructed through negotiations by actors"*. This ongoing construction can be found in the early development of Software AG. Though the actors involved in the founding had a strong agency in terms of their business model, i.e. their idea of a company based on software products was not only just an idea. It was a mind setting that was also expressed in the way the company was set up as stock company with programs as assets. However, in the early time they needed to act against this mind-setting by accepting smaller service contracts to survive. This can be explained by different time frames, experiences and future expectations of the actors. Some of the founders might have considered the company as one form of experimentation like for example Peter Kreis, the owner of AIV, who was involved in several foundations. Such an attitude benefited in particular from the city of Darmstadt as an emerging place for computer sciences and computer business. For others, like for example Peter Schnell, the underlying idea of the business had more importance. While the latter group also had more expectations towards this idea, they were willing to act, at least temporarily, against that and take service jobs to enable the further development. As a consequence they also took more control of and responsibility for the company during the reorganization of the company in 1971/72. The others, maybe partly based on their experiences with other foundations, might have had a different time frame and different expectations, which led to the fact that they are willing to hand over control.

Although this will to continue under difficult circumstances was rewarded with a first installation of the database system ADABAS, the situation was still critical. Consequently, in nearly all accounts the meeting between Schnell and Maguire and subsequently the creation of SAGNA seems to be the main event that changed the situation and led to stabilization of the company. At a first glance the process can be considered as an external contingency, but a closer look reveals that the process was

not only a random event that triggered the creation. Though the meeting was itself fortuitous, the following events did not unfold randomly. As described above Schnell as well as Maguire had a good personal relation and acknowledgement of each other, which was the basis for a continuous contact between them after the meeting. During this phase Schnell and his colleagues as well as Maguire started to realize possibilities. On the one hand, for Schnell and the others it became obvious that the more mature American market would offer a possibility to pursue their idea of selling software products, namely the existing ADABAS. Thereby they would also circumvent the problem of the less developed German home market. On the other hand it also offered new possibilities to Maguire, who saw the potential of this particular product. During the following, more or less improvised, contacts, the idea of a cooperation emerged and resulted in the foundation of SAGNA. The choice to found an independent company that received a license for ADABAS, instead of founding a subsidiary underlines the fact of an emergent and improvised process. Above that, the fact that the company was owned directly by Schnell and Maguire also shows that it was negotiation process between them as actors. This underlines that the process was more then an external contingency, but much more a process shaped by the actors and their agencies on the way.

Overall, the different processes in the early years point at two important aspects of the concept of path creation The first one, "mobilizing minds", addresses in particular the need that beyond the need of technical skills to develop a solution like ADABAS, there are also social skills required in order to mobilize other persons. This is clearly given in the case of the Software AG founders, in particular Schnell showed this skills in the relation to customers like the Westdeutsche Landesbak or in relation to John Maguire, as pointed out by himself. In reverse also Maguire possessed this capability. All in all this created an network of human and non-human actors, but given the circumstances one of the major challenges is "generating momentum", which according to Garud et al. refers to the challenge not only to mobilize, but also to maintain this network.[28] This requires iterations of these negotiations refining alignments and balances of in order to achieve convergency between the actors.

The growing years of the Software AG, 1975-1985

Though the main source of success in the mid-1970s was the US market, the Software AG also gained more stability and growth in their home market Germany. One reason was the growing acknowledgement of the success in the US, but also growing reputation in Germany itself. One reason was the growing number in customer contracts itself as it was possible to gain contracts with

the city of Vienna, the city of Munich, and the Hessische Landesbank, which also played a role in securing the further development. This type of pre-financing through customer contracts was a usual strategy for software companies at the time.[29] Another important step in achieving financial security of the project was a funding by the 2nd data processing program of the German ministry of research and technology (BMFT), which, at the beginning of the 3rd data processing program, was named by the ministry as an example of successful funding.[30] This went along with the possibility to port ADABAS to the Siemens systems.[31] This was particularly important for the development of the German market, because after IBM Siemens was the second biggest vendor of computer systems. Although IBM still dominated the German computer market at over 60%, Siemens was able to expand its market share to almost 20% by new products, cooperation and acquisitions as well as by funds from three data processing programs of the German ministry for research and technology (BMFT), of which Siemens got between 1/4 and 1/3 of all funds. Through this, not only important German companies like the Deutsche Bank or Lufthansa but also public administration bodies and institutions became Siemens customers and opened up an important market segment for the Software AG.[32]

Development of ADABAS ecosystem

Due to growing success ADABAS became the main product of Software AG. Consequently, Software AG began to extend their product environment surrounding it in the mid-1970s. First, a TP (transaction processing) monitor called COMPLETE was officially introduced in 1977. The R&D department located in the US, which was built up in the meantime, initiated the development.[33] The purpose of a TP monitors was to support computer systems' transaction oriented applications, usually OLTP, by ensuring the integrity of results in the database while various users making changes on it using multiple terminals.[34] From Software AG's point of view, the development of a TP monitor was a first step from a basic database solution towards a deeper integration into applications. The second step was achieved with their next new product, officially introduced in 1979: NATURAL, a development and programming environment to be used based on an ADABAS database. NATURAL's creation had begun in 1976 under Peter Pagé, who would go on to be a member of the executive board a short while later and Software AG's most important representative next to Peter Schnell. One of its key elements was the Natural Programming Language (NPL), which was supposed to make simple, "natural" programming possible. The idea

behind it was to give ADABAS customers a product that would make it as easy as possible for them to develop individual applications based on their database.[35]

The early 1980s saw a continuous further development of the already existing products ADABAS, COMPLETE, and NATURAL, but also the creation of new products, in particular CON-NECT and PREDICT. Both were solutions designed to complete the earlier product portfolio or rather to expand it. CON-NECT, developed based on NATURAL, was a communication solution to support the connection and integration of the increasing number of different end-user devices like terminals, workstations, and personal computers into a central database business solution. The goal was to give these devices direct access to the mainframe computer system using ADABAS and NATURAL and to allow use of database applications, word processing, mail services, etc. In order to make this possible, a series of other tools like SUPER NATURAL, NET-WORK, and NET-PAS, depending on tasks and platforms, were used together with CON-NECT, ADABAS, and NATURAL.[36] In contrast to this, PREDICT targeted another area. It was meant as a so-called data dictionary for NATURAL, meaning that it was supposed to help developers working with NATURAL to keep an overview of the utilized data and their exact usage by automatically recording everything. In 1985, this was a first step towards a long-term goal: the creation of a CASE (Computer Aided Software Engineering) solution. This idea was inspired by initiatives in Japan and the US towards building software factories as well as by related funding programs on the European and national level, which resulted in a boom in the development of CASE solutions in the mid-1980s.[37] Though it seemed at a first glance to contradict the strategy of a integrated database ecosystem, it was obvious for some reasons. One is that such a solution offered synergies to existing products such as NATURAL and were able to enrich the existing ecosystem. Another was that in the best case it would create a new market segment for Software AG beyond the database market.

Internationalization of Software AG

Another important development in this period was the continuous internationalization inspired by the success in the US. Already in 1974 the Software AG of Far East was established in Japan. Three years later, another company was founded in Great Britain. It should be noted that the companies similar to SAGNA were no direct subsidiaries of Software AG, but rather independent companies founded by Peter Schnell, sometimes in cooperation with local partners such as John Maguire. Like the Software AG itself they were founded as local stock exchange companies or similar legal forms

that licensed the products from Software AG. In the early and mid 1980s further subsidiaries were founded in France, Belgium, Switzerland, Austria, and Spain. These were joined by many other subsidiaries outside of Europe like Mexico.[38] Some of them were direct subsidiaries of Software AG, while others were legally independent companies that licensed Software AG products.

Although the new founded companies did not manage to fully repeat the success Software AG met in the US, this development still raised Software AG above all other German software companies of that time for two reasons. The first one was the high degree of internationalization at all, which led to the fact that at the end of the 1980s 75% of their sales were done outside of Germany.[39] The second one was its choice of a then unusual method of internationalization.[40] According to the seminal Uppsala model of internationalization, which was outlined by Johanson and Valhne in 1977, young companies start only to internationalize after establishing themselves successfully in their home markets. Their first step of internationalization is to then turn to geographically and/or culturally close markets before internationalizing further, step-by-step.[41] That is why it seemed logical for German software companies to expand to markets like Austria or Switzerland and then followed by other European markets. However, Software AG took another path. Even before the company was established in its home market, it started to internationalize. Moreover, the company chooses markets that were not geographically close and at least at this time showed some cultural differences. As newer research on internationalization shows this kind of pattern appears since the 1990s more often and was sometimes euphemistically called *"born global"* or *"international new venture"*.[42]

Stabilization of the company

The period between the mid 1970s and mid 1980s was for sure a phase of stabilization for the Software AG. In contrast to the stormy early years with great problems, but also with great successes, this period in the development is clearly characterized by more constancy. This stabilization was triggered by the early success, in particular the growing number of sales in the US. The success resulted into the two most significant structurational processes during the stabilization of the company, the development of the ADABAS ecosystem and the internationalization. In the first case the success of ADABAS led to a sole focus of Software AG on this product, while other ideas for software products that might existed in the beginning were not pursued any longer. Moreover, Software AG started the development of a supplementing ecosystem of further applications. Similar to that the internationalization also became a distinct characteristic of the

company, because based on the experience in the US the entry in different other markets like Great Britain and Japan in the 1970s and in other European and international markets in the 1980s shaped the identity of an international company. This was for example underlined by the focus that was set to international revenues and international customers relations within the annual reports of the company, where sections on the market development in main markets as well as reports from user groups meetings from different regional areas were a normal part. Additionally, the customer magazine of Software AG, called Software Report, included even in their German edition customer stories from all over the world as well as comments and statements from foreign customers or analysts.

Both developments show clear signs of a structurational processes, where the mutual dependency of actions, i.e. development of new products or entry in new markets, and structures, leads into stabilization over time and through routinization.[43] From the point of view of path creation this clearly shows how pre-amplifying investments like for example in new markets or in new products construct self-reinforcing mechanism. Because the increasing returns of the supplementing ecosystems products like NATURAL, where the number of installations grew nearly as high as the number of ADABAS installations, resulted from network effects within a software ecosystem. The decision to focus on an ecosystem for ADABAS and the willingness to invest in this development created further self-reinforcing mechanism. Similar patterns can be observed in the case of internationalization, where investments for entering continually new markets where done. Though they did not show the same success as in the US, in the long run they contributed to the high share of international revenues in total revenues, which formed an important part of the identity of the company.[44] Summarizing, it can be stated that in this period showed clear signs of stabilization, which were based on structurational processes shaping the identity, strategy and product portfolio of the company. These processes were triggered by different self-reinforcing mechanism created or constructed through negotiations and decisions of the involved actors.

Troubled waters – Industrial transformation and the Software AG, 1986-1996

The successful development of the late 1970s and early 1980s seemed to continue in the late 1980s. Main reasons were the growing success of the ADABAS ecosystem portfolio and the continuous internationalization.

The main products despite all new developments were still ADABAS and NATURAL. Thus, the number of ADABAS installations went from almost 700 in 1981 to considerably more than 2000 in 1985 and 3700 in 1989. Between 1981 and 1985 the number of NATURAL users went from 500 to almost 2,000. Later on it is only stated that a correspondent number of installations exist.[45] In addition, these applications were constantly being maintained and further developed. In 1987 NATURAL 2, PREDICT 2, CON-NECT 2, and ADABAS version 5 were published and new solutions and enhancements like ADABAS SQL were released.[46] Three years before that, a step towards exploring the world of mini computers was made with the porting of ADABAS and NATURAL to the DEC/VAX platform.[47] Beyond that, Software AG had in total 24 international subsidiaries outside of Germany, of which 13 where non-dependent subsidiaries, i.e. license companies. Out of the 24 were 11 national subsidiaries in Europe, 6 in North and South America and 5 in the Asian-Pacific area and two sales organizations for the Middle East and Africa.

The resulting success is mirrored in their sales development. Here, it could clearly be seen that Software AG had begun to grow above average, which began in the late-1970s after they gained stability. That is why it comes as no surprise that, since the beginning of the 1980s, the average yearly growth was above 40% and that the revenue multiplied by more than ten in 1989, going from 12.07 million € in 1981 to 165.71 million €. In addition to that, the number of employees grew in the same way. This development reached its climax in 1988. It was then decided that the SAGNA, originally owned by John Maguire and Peter Schnell, should be completely taken over. In order to achieve this, all shares of the by then listed company had to be bought.[48] The realization of this project posed a considerable consolidation, which was also reflected in the key company figures of 1987 and 1988. At the same time, it kicked off the celebrations of the 20th anniversary of Software AG in 1989. By this point, Software AG was as already mentioned the biggest software company in Germany and already in the mid-1980s among the 15 biggest independent software vendors in the US.[49]

Insert table 1 somewhere here around

After the celebrations in 1989, the situation started to change rapidly for the Software AG. Main causes were two developments. The first one, which was called by Langlois the *"vertical disintegration"* of the computer industry,[50] consisted of a set of developments such as the advancing miniaturization, the emergence of personal computers, and the growing interconnection of application and devices. The second one was the appearance and rise of products based on

general relational data base models during the 1980s. In particular, the interplay of both changed the market for databases and thereby posed a challenge to Software AG.

The changing structure of the industry

The *vertical disintegration* started with several convergent developments that began in the 1970s, but only gradually started to reach their full impact during the 1980s. The main impact of it was the development of the decentralized Personal Computer (PC) or microcomputer industry, whose breakthrough brought not only computers to company desks, but also into private homes. Additionally, new concepts for operating systems and infrastructure concepts played a role during this change. Most severely affected by this were computer system manufacturers like IBM, Siemens or Nixdorf, who dominated whole market segments with their closed hard and software systems. Still, it initiated a shift of information technology structures that not only affected hardware technology but along with other products, also lead to a fundamental change in the relation between hardware and software industry. Until then independent software had often been nothing more than a niche business, but the new open architectures shifted the balance in favor of the independent software producers.[51] Reasons were the changing demand of companies, which aimed for new types of applications caused by decentralized concepts of using computer systems, as well as the increasing demand of private users and the resulting mass-market with new distribution and revenue possibilities. While this disintegration mainly hit the computer system manufactures, the market for databases also experienced far-reaching changes at the same time in the mid-1980s. The first step was the introduction of relational database management systems, initiated by IBM when they published DB2 in 1983. With this, the downfall of the then dominating hierarchical database systems began. These were still characterized by the necessity to clearly define what was to be requested during their design. In contrast to this, relational databases, designed with Codd's principles in mind, facilitated a flexible connection of existing data. They were thereby able to generate entirely new data by letting the user phrase his or her questions in the Structured Query Language (SQL).[52]

Cullinet Corp. was the first database company to fall victim to this change. By prematurely announcing the conversion of all their systems to relational systems, they deprived themselves of their own customers and slowly went bankrupt. While other traditional companies like ADR also fell victim to those events, Oracle as a new entrant in the market managed to become the most important supplier next to IBM. And that even though Oracle's focus was databases for UNIX

systems as opposed to the mainframe-oriented DB2.[53] When these systems together with the client server architecture lead to an enormous growth in diversified, relational database systems, Oracle, side by side with SAP and Microsoft, was among the few winners of the crisis. Especially when using a database, the new client server architecture showed its advantages. Until then, in a normal host terminal system, the database itself as well as database applications was filed away on a mainframe computer. If a request was made from a terminal, the files on the database were read and processed on the mainframe, and only the final result was sent to the terminal. However, when using client server architecture, the client, most likely a PC, sends his or her request to a database server that is installed on one or more computers and executes the request. Afterwards, it sends the files to the client and the final processing and editing/presentation take place there. On the one hand, this made the process faster since only crude data had to be retrieved. On the other hand, the user was able to influence how the data was presented on his or her computer with this application instead of having to make a completely new request to the mainframe database application. Furthermore, client server architecture allowed for a larger number of users to access limited resources like databases or printers because of the system's better load distribution, redundancy, and better reliability.[54]

Software AG and the change

These changes began to affect Software AG already in late 1980s since the company was more involved in the American market than other foreign companies. However, at a first glance the transition towards relational databases seemed to affect Software AG hardly or even make them one of the winners since they had always followed their own technological concept with ADABAS, which already included some advantages offered by the relational databases. As a consequence the emergence of relational databases were not considered to be a threat and a reaction to the change only came slowly. A single response was the introduction of ADABAS SQL in 1987, which now made this request language available to all ADABAS users.[55] But this neglected a more fundamental challenge to the database market caused by the client server architecture and other hardware developments. The point here was that ADABAS and all related applications were designed mainly for use on mainframe computers with big data volumes and high performance requirements. Only a small step towards other platforms was taken with the porting of ADABAS to the DEC/VAX platform in 1984, but this was only a minor segment for Software AG and the mini computers to which VAX belonged became itself victim of the vertical disintegration. Due to the

belief in the mainframe technology Software AG missed its chance to port their system to UNIX-based distributed databases early on. This belief was also explicitly expressed for example in the annual report for 1989, published in 1990. Here, the development towards UNIX-base client server architecture is described as one of the major changes of the time. But instead of concluding the need for reaction, the main argument was that this represents not "revolution", but more an "evolution" that will not replace all current solutions.[56] Though one can argue that this evaluation of the situation in the long-term might be true, it underestimated the threats for Software AG in this situation. When they finally reacted in 1990-91 by porting ADABAS to a client server environment using UNIX within a very short time, it seemed like a very progressive step compared to other German software companies. But given the fact that one of the company's main markets was the more matured US market, the step was taken too late. Consequently, they were not able to profit on a large scale from the rapid changes of the market. This is confirmed by a closer look to the financial development in the early 1990s. It reveals that, even though Software AG's revenue still grew in the years after 1989, the growth was quite poor compared to the new entrants in the data base market such as Sybase or in particular Oracle. Moreover, this growth was mainly based on enhancement and maintenance contracts for the already installed software products ADABAS and NATURAL, while new products generating new growth were lacking.[57] As a result, Software AG was in a critical situation in the early 1990s. After long periods of success and growing returns, the company was confronted with stagnating and later even decreasing returns and a technological core that was questioned by new technologies. Even the international success started to suffer in general due to a worldwide recession in the beginning of the 1990s.[58]

For some time, all hopes rested on the establishment of a product for the new market segment for CASE tools. A first step towards this was made in 1985 with the introduction of the application PREDICT. Though it took some efforts, the application was further developed throughout the following years towards an integrated software development environment, and as of 1989 was called PREDICT CASE. At that time, it supported the requirements analysis and specification of features and data. It facilitated a direct implementation in NATURAL and the automatic generation of programs.[59] However, like several other CASE projects, it lagged behind the original schedule and until that moment it was only deployed to a few selected European customers. Thus, it did not differ from many other projects in this area and, just like the others; it did not meet the expectations. Critique of the underlying software factory approach also grew louder. It was too obvious that manufacturing concepts from mechanical engineering were not apt to be transferred to the field of

software.[60] Additionally, during the worldwide recession and the computer industry crisis in particular, the willingness to implement complex and partially unfinished solutions decreased considerably. This eventually lead to the failing of CASE applications including PREDICT CASE, no matter how high their quality was.

The search for new directions

Adding to all other problems in the 1990s, some problems now emerged within Software AG in spite of its previous success and shown harmony. It started when essential personnel like John Maguire, who, after the integration of SAGNA, had still been CEO of the important subsidiary in the US, left the company. According to his own short statement, he left because of a disagreement on the further orientation of the company.[61] Whether it was in reaction to that or one of the causes is unclear, but the two key Software AG board members at that time, Peter Schnell and Peter Pagé, had also a falling-out concerning the further orientation.[62] In the end, Peter Schnell was able to win that argument since, largely unnoticed by the general public, he had become the sole shareholder of Software AG after Peter Kreis' changeover in 1983. As a result, Peter Pagé left the company in January of 1993 and moved to Siemens-Nixdorf. Peter Schnell simultaneously began with the consolidation and restructuring of Software AG. In order to do that, he disintegrated Softinterest Holding AG, a company located in the Swiss town of Zug, also owned by him. It had controlled many shares of Software AG's international subsidiaries and, consequently, a considerable amount of the total turnover. As part of an increase of capital stock, a small part of these shares was sold to Software AG itself, while the bigger part went to two foundations that had been the proprietors of Software AG since 1993. These foundations were Software AG Foundation, a charitable organization that now held 98% of all shares, and Software Industry Foundation, holding only 2% of the shares but having full voting rights because of the stock company's structure. Both foundations were founded by Peter Schnell and supplemented by the company's advisory boards.[63] The consolidation of ownership structures led to a needed increase of capital and was a clear rejection of rumors that had been spreading for some years about a fusion with or rather takeover by SAP.[64] Those rumors were already being spread for a while and then once again reignited when a cooperation of Software AG and SAP in the field of database use was announced in 1992. However, it was actually one of Peter Schnell's first steps in reaching the desired substantial reorientation of Software AG. The goal of it was to create another pillar next to the traditional software product business by expanding into IT services. The idea behind was to offer customized

solution for user through the integration and adaption of standard system software and standard application software.[65] This development reached its climax in 1997, when SAP Systems Integration (SAP SI) was founded, a joint venture with SAP of which Software AG held a share of 40%.[66]

A central pillar for this new strategy, which sought to profit from the paradigm shift to a decentralized infrastructures in IT, was a new product called ENTIRE that was announced 1990. In a nutshell, it was based on the idea to turn inherent weaknesses into strengths. Just as Software AG and their products were still strongly focused on mainframe computers, many users were faced with a similar problem. On the one hand, they still worked with important infrastructures on mainframes, while their companies had started to increase the number of small and medium systems using partially client server-based concepts on the other hand. The result was an island effect, where different unconnected infrastructures existed beside of each other. This caused an increasingly unsatisfactory situation that was also responsible for high costs. ENTIRE was supposed to be a general integration tool for mainframe, medium, and small computers in client server environments enabling user to overcome this situation. However, just like with many other development projects finalization was delayed again and again and, when it was finally introduced on the market, its range of functions was ultimately unsatisfactory.[67] Only the revised version ENTIRE X, available as of the mid-1990s, was able to reach the desired potential.[68]

Stabilization and lock-in

The period between the mid 1980s and the mid 1990s marked a clear watershed in the development of Software AG. The growth of the company hit a peak around 1989/1990, which was marked by the integration of SAGNA and the 20th anniversary of the company, but shortly after that growth stagnated and the company found itself after years of success in troubled waters.

The main question posed is why Software AG reacted so late on the changes, in particular to the vertical disintegration of the computer industry and the rise of the relational data base market. Especially, since these developments did not occur overnight and that the resulting market changes, in particular the rise of UNIX-based relational databases, were also subject of regular market reporting, the consequences were not fully unpredictable. Moreover, the analysis provided in the annual report of 1989 underline that the leading actors were aware of it, but the following argumentation on the importance of mainframe computers and the fact that the whole was never a

topic before in reports of the company seems to show that they were for a long time convinced that this would not directly affect the business of the Software AG. This was based on two convictions. One was the believe that the new generation of relational database did not outperform the technology underlying ADABAS and its ecosystem, in particular in terms of performance that was important for applications such as OLTP. The other point was the fact that they underestimated the effects of the client server architecture based on UNIX and its interplay with the opportunities of relational databases. It developed a great appeal for the end user, i.e. normal employees and the middle management for some reason. Until that computing capacity and data were part of the central data processing departments, which often caused frustration for example by inflexible, slow responses, which did not meet the requirements of a more and more dynamic day-to-day business. As a consequence, the end user achieved more flexibility by easier data retrieval and manipulation and gained also more control over the data.[69] This created a strong motivation to migrate to decentralized structures, sometimes even outside the official IT structures.

An answer to the question why the reactions to the development took so long is that Software AG experienced a lock-in. The lacking perception of changing customer needs and the continuous focus on performance showed that the idea or belief in the concept of ADABAS shaped how the leading actors perceived the world. An example of this process is the annual report of 1989, where the challenge of the changing markets was described in a way as it would not represent a problem for Software AG. In that regard the idea of ADABAS shaped the perceptions of the actors in a specific way and prevented them to look at it in a different light. The strong believe in its product ecosystem led to a lack of ability to deal with emerging developments, which is a clear characteristic of a lock-in. In the concept of path creation it is defined as a "*provisional stabilisation within a broader structurational process*". The success of the existing paths, the internationalization and the ADABAS ecosystem, created as described a kind of stabilization, which prevented the leading actors of the company to react on the broader structurational process caused by the disintegration of the computer industry and the rise of relational databases. Furthermore, the reactions on the crisis support the emphasis on the actors and their agencies in the concept of path creation. The arguments around the re-orientation reveal that the actors even developed different viewpoints and agencies. Though it is relatively few known about the actual contents, the consequence of lost convergency between them was that several main actors such as Maguire or Pagé left the company.

The following consolidation of the complicated owner and organizational structure was one central aspect of the overall restructuring of Software AG in the early 1990s. Another main focus of the restructuring was the stronger orientation towards supplementing IT services based on the idea to work as an integrator of IT infrastructures. This was complemented by a partnering strategy, which was also new for Software AG. All in all, this restructuring started to change the culture and identity of the company from an international software product company to an integrated IT services and software provider during the early 1990s, which marked a break in the existing path.

Continuous renewal – Software AG after 1996

When the Software AG's reorientation towards an integrated IT service and software provider was on its way by the mid of the 1990s, culminating in its investment in SAP SI, Peter Schnell took the opportunity to retire from being an active manager of the company in 1996. This also included organizational restructuration such as the full integration of the international subsidiaries.[70] As a part of this change, the Software Industry Foundation completely dissolved into the charitable Software AG Foundation, henceforth looked after by Peter Schnell, who had already been supporting several non-profit social projects since the early 1980s. His position as CEO of Software AG was from now on taken over by Erwin Königs, a former employee of Nixdorf and former CEO of Linotype-Hell. He continued the company's reorientation as an IT service company and met the challenge of renewing Software AG's range of products in the beginning of the digital economy. While the products ADABAS and NATURAL were mostly just being maintained during the turn of the Y2K preparations, he concentrated on refining the integration tool ENTIRE as the main pillar for the new IT services business and the development of new software product solutions for what was at that time called eBusiness.[71]

Software AG and the dot-com boom

Since its first appearance in the early 1990s ENTIRE was further developed to become a fully adequate Enterprise Application Integration (EAI) solution, which was serving as middleware to facilitate applications across existing and partially very diverse hardware platforms. The thought behind this concept was that many companies are not able or willing to change the system landscape they had been building for years and, instead, depended on connecting them and using them as effectively as possible.[72] A major step towards this was achieved with the release of ENTIRE X, which included a general communication server for all platforms enabling cooperation between Windows, UNIX and mainframe systems. This made it to a success for Software AG.[73]

Products depending on two completely new technologies were in the focus of development within Software AG's newly business of electronic business. The first new product was BOLERO, a development environment based on Java. It was supposed to help companies create eBusiness applications utilizing newest technologies in a simple yet professional manner. These applications should be based on the likewise newly developed TAMINO information server. This server mainly consisted of a database infrastructure using XML (eXtensible Markup Language). This description language and the database structures connected to it were specifically designed for processing various data from new eBusiness applications. The key idea behind this development was to build a platform-neutral ecosystem like as before with ADABAS and NATURAL based on newest technologies.[74]

However, Software AG not only tried to profit from the boom of the dot-com economy but also to become part of it as a company. That is why, in 1997, shortly after selling SAGNA that was going on to trade under the name SAG America (SAGA), the company started to prepare to go public.[75] This process was finalized during the peak of the dot-com economy boom in April 1999 and was a huge success, which is why Software AG was very quickly included in the "Neuer Markt" (NEMAX), the German counterpart to the NASDAQ at that time. Software AG's increasing market price was supported by increasing sales, which had begun to rise again significantly after the up and down years of the early and mid-1990s. Additionally, many analysts were excited about the new marketing ideas like the so-called business alliance strategy aimed at finding smaller, fast growing software companies with promising ideas and convince them to incorporate the TAMINO information server in their products. In return, Software AG promised to distribute their products within its worldwide sales network that still distinguished it from many other companies.[76]

The end of the dot-com boom and another reorientation

At first, the success of TAMINO and BOLERO shortly after their introduction to the market in 2000 seemed to confirm the value of these new strategies. However, the dream of the dot-com economy did not last forever. The first warning signs of a crisis emerged already in 2000. The business models of some newly founded companies, of which the market price frequently exceeded their actual sales and prospects considerably, clearly failed and the companies had to go bankrupt. The following stock market crash between August of 2000 and April of 2001 signified the irrevocable end of the boom. The abrupt ending also had far-reaching consequences for Software AG. With TAMINO and BOLERO, representing technologically innovative concepts, Software

AG's strategy had largely failed. Though the financial results for 2001 showed a sales growth of 40% and made a record-breaking turnover of €588 million, the numbers revealed the first problems. This result could be traced back to the (re)purchase and integration of SAGA systems, on the one hand, and to a massive revenue increase due to ADABAS and NATURAL on the other. In the meantime, sales of BOLERO and TAMINO were significantly lower than expected, which indicated the upcoming problem.[77] One important one was, that many of the longtime ADABAS customers had felt left out because of the focus on eBusiness and had been very cautious with regard to converting to the new concepts. They felt that their concerns were confirmed, when in 2002 the initial quarterly figures made it quite obvious that such a result could not possibly be achieved again and that a massive sales decline was to be expected instead due to the crisis after the end of the dot-com boom and 9/11. As a consequence, Software AG's share price fell and put pressure on the company to adjust their strategies accordingly. As a reaction in personnel, CEO Königs left the company in November of 2002. For almost a year afterwards, Vice Chairman Achinger was in charge of the company and started its financial consolidation until Karl-Heinz Streibich took over chairmanship of the board in the fall of 2003. The latter continued the financial consolidation and reorientation away from eBusiness once again towards an integrated IT services and product company. The goal of this measure was to refocus on the core business of the company, namely software and services for business infrastructures. This meant that the existing product portfolio based on ADABAS, NATURAL, ENTIRE and XML based solutions was consistently further developed and that the company expanded into new segments such as business process support. A number of acquisitions should help achieving that goal, including the purchase of Webmethods, an American specialist for service-oriented business process support, in 2007 as well as the 2009 acquisition of IDS Scheer, the third largest German software company following SAP and Software AG and specialized in business process modeling.[78]

Though it seems that finally Software AG re-entered the path of growth, the development during the late 1990s and early 2000s reveals the difficulties of breaking old paths. While the first reorientation in the early 1990s towards a more integrated, less product based business model seemed to be successful at a first glance. But already around 1996 new problems emerged and the chances of the dot-com-boom revived some old patterns, the focus on software products. In the beginning it seemed to be a promising way, but the burst of the dot-com bubble ended it drastically. The difference to the crisis in the early 1990s was that at this time the organizational and economical preparedness was better. One reason was the existence of new business areas like IT

services offered a basis for further operation. In addition, several products like the EAI solution supported this. Even later the XML technology could be embedded in this environment. Another difference was a clear organizational structure that enabled direct reaction on the different developments. Therefore, the return towards the idea of an integrated IT services and product provider was not a new change in the organizational culture again. As of today, it looks like that in the following years a final turn around was achieved.

However, a look at the reorientation process as a whole shows that it took Software AG a considerable time to overcome the "lock-in" from the late 1980s. Similar to the early stage of path creation this process is also characterized by different sorts of experimentation. In the course of it different strategies and approaches were tried. Some of them remained like for example the orientation towards Enterprise Architecture Integration, while others were declined or at least significantly transformed like the XML technology. Though the annual reports indicate underlying strategies, a review of the process reveals that it was not a linear development. Instead it seemed that the different actors negotiated and thereby improvised the development rather then followed a devised strategy. One example is the reaction of Software AG during the dot-com boom. In this period the previous reorientation towards IT services was neglected in favor of a more product-oriented strategy, which reminded of the earlier business model of the company. After the dot-com crisis this strategy was discarded, though parts of the products like the XML technologies merged into the other portfolios of the company. In the years after the company reinforced the trend towards IT services and complex business solutions. Thereby it seems that a new stabilization was achieved, also by utilizing the internationalization of the company throughout the whole process. This re-stabilization of company after a lock-in or temporary stabilization before is not yet explicitly reflected in the theory of path creation. One reason might be the perception that in many cases companies does not manage to overcome the situation and therefore cease to exist. However, there are cases where organizations or technologies survived, maybe either in niches or in new contexts or business models, and a comparative study could help to improve the understanding of this part of the process of path creation.

Conclusions

Summarizing it can be stated that the history of the Software AG is an interesting case within the short history of the software industry, because it is an early example of how the development of a company can be influenced by success in the early stage and thereby shapes the future of a

company. Applying the concept of path creation, which shades a light on the agency of the actors instead of focusing only on external events, gives insights why Software AG entered the US market so early and in particular why they were able to succeed in this market. Highlighting the actions and motivations of the different actors as well as events within and outside of the organization it also explain how it affected the organizational structure and culture. Moreover, it also explains what happened when growth stagnated in 1990s and reorientations took place. As a result, the case provides four conclusions addressing challenges in the development of technology-based companies.

The early success in the US as a European, independent software company was quite unique at this time. As shown by the analysis it was based on several, interrelated factors: firstly, the belief of a small group of people into the concept of software products; secondly, their technical skills to develop a solution offering advantages to comparable products; thirdly, the fact that it addressed a market that was already mature enough to allow a sustainable development; and fourthly, the social skills of the involved persons, especially of Schnell and Maguire, resulting in a dynamic process that enabled the early entrance and success on the US market. This underlines that a successful start-up requires more then a well-working technology. Additionally, social skills enabling the involved persons to problematize relevant aspects, interest and enroll new actors and mobilize them are also key factors for success.

Though many typical problems of fast growing companies appeared in the first years, the success resulted into at least two structurational processes that shaped the company: the continuous internationalization and the development of the product ecosystem for ADABAS. The main driver for it was increasing returns in terms of growing revenues. But as shown by the analysis, these self-reinforcing effects were strongly affected by the agencies of the actors and the alignment of them. For example, the success of the internationalization, which was seen confirmed by the high share of international revenues, was a consequence of a strategy pursuit by leading actors resulting in the continuous entrance of new international markets, which led to increasing revenues. In a similar way was the success of the ADABAS and its ecosystem a result of a strategy. It is clear that strategies alone are not decisive, but that the related concurrent negotiations between the actors are one important part of the continuous mobilization of people based on vision and enabling experimentations. This also clearly has a self-reinforcing character, because the growing success in terms of revenues once again stabilizes and feed the mobilization process.

The following stabilization of Software AG resulted in a position of the company among the leading independent software companies in Europe and the US, which was unique for the late 1970s and early 1980s. But soon the other side of this would become obvious. The success of the company led to a strong focus on ADABAS and its underlying technical concept, which is based on a special form of the relational database model best suited for mainframe based applications with high performance requirements. Given this, new developments such as the rise of new database applications based on the general relational database model and the vertical disintegration of the computer industry, which resulted in a fundamental change of the market. Instead of utilizing experimentation and bricolage to adapt to the situation and develop solutions, which was an important part of the success of the company in the early years, the lock-in of the actors led instead to a reinterpretation of the market developments. As for example shown by the annual reports the challenges were perceived, but turned in a way that they did not represent a threat. This clearly underpins the need to establish permanent procedures in a company that are suited to challenge the performative power of ideas and believes within the organization seriously and to maintain flexibility and experimentation as part of the organization.

Not surprisingly, Software AG got into trouble as the change of the market and industry gained more and more momentum. Within a very short time the company lost its position as a leading software company and even a short-termed adoption of the new paradigm could not prevent that Software AG could not participate in the overall growth of the database market. In this situation a reorientation of the company was inevitable, but the process revealed that the previous alignment of different actors was lost. Their agencies diverged and the lack of success and related self-reinforcing mechanism could not help to stop the process of falling apart. As a consequence power fights led to the fact that several actors left the company and new direction towards integrated software and IT services company was initiated. Though the remaining founder, who decided the power fights for him, started and managed the early phase of the reorientation, the analysis of the development of Software AG over the following years clearly showed the difficulties of such a process. It requires again experimentations, which are difficult to initiate in long-term established structures that often unfold a strong durability and are reluctant to change.

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Table 1 and table caption

Year	Revenues (in million €)	Yearly growth of revenues in %	Employees	Yearly growth of employees in %
1973	0,66	-	13	-
1974	0,92	39,40%	12	-7,70%
1975	1,64	78,30%	14	16,70%
1976	2,10	28,00%	18	28,60%
1977	2,66	26,70%	18	0,00%
1978	3,58	34,60%	23	27,80%
1979	4,35	21,50%	29	26,10%
1980	6,24	43,40%	34	17,20%
1981	12,07	93,40%	41	20,60%
1982	16,82	39,40%	56	36,60%
1983	22,91	36,20%	81	44,60%
1984	40,39	76,30%	134	65,40%
1985	56,75	40,50%	272	103,00%
1986	77,21	36,10%	375	37,90%
1987	87,38	13,20%	497	32,50%
1988*	117,60	34,60%	1.432	188,10%
1989	165,71	40,90%	1.907	33,20%
1990	234,63	41,60%	2.232	17,00%
1991	284,48	21,20%	2.359	5,70%
1992	315,93	11,10%	2.822	19,60%
1993	339,93	7,60%	2.716	-3,80%
1994	357,96	5,30%	2.793	2,80%
1995	403,00	12,60%	3.327	19,10%
1996	271,60	-32,60%	2.468	-25,80%
1997	294,10	8,30%	2.096	-15,10%
1998	320,30	8,90%	2.186	4,30%
1999	365,90	14,20%	2.639	20,70%
2000	416,60	13,90%	2.846	7,80%
2001	588,50	41,30%	3.326	16,90%
2002	475,00	-19,30%	3.013	-9,40%
2003**	420,00	-11,60%	2.577	-14,50%
2004	411,40	-2,00%	2.438	-5,40%
2005	438,00	6,50%	2.750	12,80%
2006	483,00	10,30%	2.621	-4,70%
2007	621,30	28,60%	3.479	32,70%

2008	720,60	16,00%	3.526	1,40%
2009	847,40	17,60%	3.603	2,20%

Table 1: Key figures of Software AG until 2009 * since 1988 number of employees worldwide, before only Software AG Deutschland; ** since 2003 accounting according to IFRS); Sources: until 1986 personal records of Peter Schnell, afterwards Software AG annual reports.

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