

“Mapping Strategic Thought and Action in Developing Disruptive Software Technology: Advanced Case Study Research on How the Firm Crafts Shared Vision”

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Mapping strategic thought and action in developing disruptive software technology: advanced case study research on how the firm crafts shared vision

Abstract

This case study uses two story-telling methods for analysis – an advanced hermeneutic framework and an extended form of decision systems analysis (DSA) incorporating cognitive mapping – to explore the strategic thought in building a software house around a philosophy of “best practice” application development. The paper explores decision-making for turning an ambitious vision (automation of enterprise-based sales and marketing activities) into a focused application (pricing configuration software), and then into a large software house (Trilogy) offering enterprise e-commerce suites. Trilogy’s management team’s decision-making was heavily influenced by a strong perception that the organization needed to take risks to achieve “critical mass” in anticipation of a convergence of “back-office” and “front-office” applications into one market. The advanced case study also addresses Trilogy’s transition of its applications into Internet environments, plus the transformation of the organization from a product-orientation to a strictly industry-based business and application development perspective. Trilogy has not compromised its strict application development philosophies, but has incorporated its fast cycle time (FCT) methods into its industry-focused business divisions – and now actually offers the method as a set of services.

Keywords: mapping, strategic, thought, software, development, case study, hermeneutic, research, development, commercialization, innovation.

Introduction

The article presents and applies a hermeneutical framework (Arnold & Fischer, 1994; Thompson, Pollio, & Locander, 1994; Thompson, 1997) in research on B2B decision making. The case study research in the present report follows Woodside, Pattinson, and Miller’s (2005) hermeneutic template and Huff’s (1990; also see Huff & Huff, 2000) mapping strategic thought templates. The article describes conceptual and research tools for achieving deep sensemaking of what happened and why it happened — including how participants interpret outcomes of what happened and the dynamics of emic (i.e., transformations in informants’ own interpretations of what happened and why it happened) and etic (i.e., transformations in researchers’ views about what happened and why) sensemaking. This report includes doing fresh “re-research” — that is going back to original informants to learn their further reflections on what happened and why events happened, along with how these informants interpret earlier researchers’ reports that followed from earlier case research studies on the informants’ thinking and behavior (cf. Langley, Mintzberg, Pitcher, Posada, & Saint-Macary, 1995).

Dynamic sensemaking relates to and advances from hermeneutical research. This article defines hermeneutic research as the inclusion of multiple rounds of informant-researcher interpretations of the dynamics of a specific situation framing-problem-decision-action-outcome by reflective analysis of

autonomous text and multiple interviews of the same and different persons in different time periods.

Table 1 outlines the main features of the Advanced Hermeneutic Analysis Framework. Table 2 presents the Framework in terms of multiple ETIC-EMIC interpretations.

Table 1. Advanced hermeneutic analysis framework

1. Hermeneutic analysis – written accounts, then revisitation, review and reinterpretation
2. Writing and revisitation using sensemaking “package”:
a) decision system analysis (DSA);
b) DSA models;
c) event chronology maps;
d) cognitive maps.
3. EMIC-ETIC iterations

Table 2. Advanced hermeneutic analysis framework – ETIC/ETIC iterations

A system for sensemaking – iterations
1. First level: EMIC1 (internal view of decision maker).
2. Second level: ETIC1 (researcher who wrote first story).
3. Third level: ETIC2 (researcher who developed DSA package).
4. Fourth level: EMIC2 (view of decision maker after reviewing DSA package).
5. Fifth level: ETIC3 (revision of DSA package by researcher who developed DSA package).

Harvard Business School (HBS) cases, describing the histories of enterprises along with specific problems-actions-outcomes for these firms, are examples

of autonomous text that may be incorporated into a hermeneutic framework. The present article includes re-interviewing informants participating in interviews for the original HBS case report and reporting these informants' interpretations of the original researchers' case report; the present article includes collecting additional data relating to the decision process and outcomes examined in the original case as well as relevant data from subsequent time periods.

Thus, the present report includes informants' interpretations of researchers' interpretation of prior informants' decisions and actions. Prior reports of multiple rounds of interviewing informants that include informants interpreting researchers' findings appear in B2B marketing literature (e.g., Howard and Morgenroth, 1968; Howard, Hulbert & Farley, 1975; Woodside and Samuel, 1981). The inclusion of different sets of researchers, the systematic collection of additional data not included in the original report, and the retrospective focus, represent a unique contribution by the present article.

1. Background on the firm

Trilogy Inc., of Austin Texas provides enterprise software focused on reducing the costs associated with "front-end" or "selling chain activities", including sales and marketing. Trilogy emerged in 1991 from a group of Stanford University students pursuing the development of software to configure and price computer hardware parts.

Trilogy was selected for research on mapping strategic thought because the firm provides rich detail on software application development, both in the initial HBS case study accounts, and from the respondents within the company in follow-up personal interviews conducted for the present report. Strictly speaking, Trilogy's software application is not classified by Christensen and Raynor (2003) as a disruptive technology. However, Trilogy was a pioneer in developing applications to specifically reduce sales and marketing costs that evolved into B2B E-commerce systems that may in 2007, arguably be now classified as disruptive technology – or at the very least powerful sustaining technology.

The case study for the project traces Trilogy from its inception from an idea to address a specific marketing problem through to competing with large ERP organizations in the late 1990s and is extended to cover a new phase of industry-focused application development and delivery in 2001-2002.

The initial decision systems analysis (DSA, see Capon & Hulbert, 1975) model, events chronology map, and the three cognitive maps for this case were developed from extracts drawn from Austin's (1998) HBS study "Trilogy (A)". Austin, with

Mandel, wrote an additional short note for the Case study, "Trilogy (B)" addressing the spin-off of several Internet-based on "Dot.com" businesses from Trilogy in 1999-2000 (Mandel & Austin, 2000).

The main purpose of Austin's (1998) and Mandel & Austin's (2000) case study was to explore risk-taking in terms of creating and rapidly growing a new business and instilling such a culture in the business, and particularly in software development. Austin outlined the creation and rapid development of Trilogy from 1991 to 1998, while Mandel & Austin note a list of spin-off businesses out of Trilogy in 1999-2000. The case is relevant to this project because Austin provides a substantial account of application development and its central role in Trilogy's corporate culture. Trilogy's early applications were developed mainly in C++ but were transitioned across to an Internet-based platform using Java and XML from 1997-1999.

Austin's (1998) account of the application is sufficient for the development of a representative DSA model and to undertake further analysis on application development and delivery. The DSA model and maps for this case were updated, plus extension questions on dominant logic, shared vision, key leverage points and strategic marketing issues were addressed through interviews. The interview participants were one of the key players in the HBS case study, who is still with Trilogy, and the current Vice President of Development at Trilogy (see Franke, 2002a, 2002b; Hyams, 2002).

2. Trilogy case study hermeneutic analysis

Five levels of hermeneutic analysis were developed to address decision-making issues, events, and linkages in the Trilogy case study. Figure 1 (see Appendix A) provides a complete picture of analysis levels 1 through 5.

The original case study by Austin (1998) serves as the etic 1 report of the case study – although there are elements of emic 1 (i.e., reports by informants in the original case study report) reporting in the form of direct quotes from decision-makers in the account. Quotes and perspectives from decision-makers were encapsulated the Level 1 emic analysis in Table 1. Key case study issues as articulated by Austin (1998) were added to the emic 1 data in the Level II analysis (see Table 2) and presented as etic 1 (reports by researchers in the original case study report) data. These issues include the following points:

- ♦ high risk-taking to rapidly develop a software house capable of taking very large erp competitors;

- ◆ very strong focus on application development excellence;
- ◆ trilogly rated itself as superior to microsoft for application development;
- ◆ its application development approach focused on rapid development in small teams of super-programmers specially developed by trilogly to maximize quality and speed of application development;
- ◆ trilogly programmers were rewarded highly and encouraged to take risks with defined boundaries.

The Level II analysis also explored mental models and decisions/actions associated with these issues.

The third level of analysis is an etic 2 (new reporting by new round of researchers) representation based on the current researcher's summarization of event milestones and the emic 1 sensemaking views identified in the data in the Austin's (1998) case study. Austin's (1998) account focuses on the decision-making associated with identifying the automation and reduction of sales and marketing costs as a major unmet enterprise need and developing a comprehensive e-commerce application suite over time to address this need. The account also highlights application development excellence of a core value in Trilogly's corporate culture. The account was sufficient for the development of an initial (etic 2) representative DSA model and to undertake further analysis on application development and delivery.

The initial DSA, event chronology, and cognitive maps reported below offer details supporting the third level analysis. Etic 2 perspectives are mainly based on the initial DSA model, initial events chronology map, and initial cognitive maps.

Key etic 2 issues include the following points:

- ◆ a company with an unusually strong emphasis on application development;
- ◆ focus on small team application development;
- ◆ not initially focused on internet-based development but shifted quickly toward e-commerce in the late 1990s;
- ◆ focused on "anticipatory" competitive actions.

The etic 2 DSA model and maps for the case were updated following extensive questioning of the accuracy and completeness of the original Austin's (1994) case – the collected data represent emic 2 material and were added during the fourth level of analysis. Thus, additional (emic 2) data were collected for etic 3 description and interpretation of the decision-making process as reported in the original case study, and for the period of four years beyond that reported by Austin (1998) and three years beyond Mandel & Austin (2000). Emic 2 data consist of responses from interviews with the principal developer of Trilogly's

"SalesBuilder" application, and the current (as early 2003) VP of Development at Trilogly (see Franke 2002a & 2002b; Hyams, 2002a & 2002b).

The fifth and final level of the analysis (see full analysis in Table 3) with the addition of etic 3 data summarizing emic 2 interpretations of mental models and events covered in the original case study as well as the work completed for the etic 2 interpretation – including the DSA, event chronology, and cognitive maps developed for the etic 2 interpretation. The revised DSA, event chronology, and cognitive maps presented in subsequent sections below follow from the emic 2 interpretations, and these maps are part of the etic 3 interpretation.

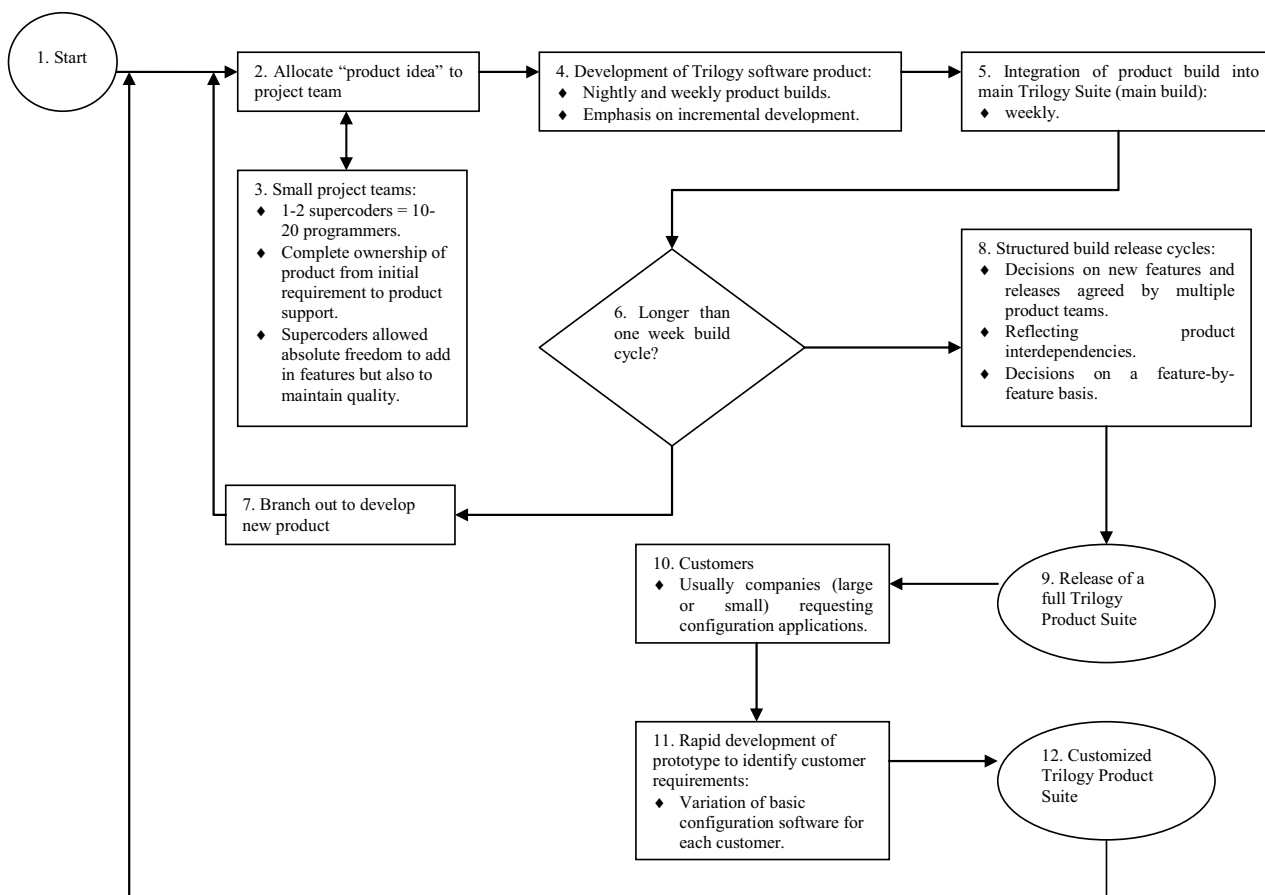
The new data from the emic 2 and etic 3 rounds of interpretation validated etic 2 data and highlighted new insights related to the following topics:

- ◆ transformation to vertical industry-focused divisions;
- ◆ trilogly application development philosophies maintained in restructured divisions;
- ◆ trilogly actually turned its application development philosophy into a product/methodology;
- ◆ can Trilogly's philosophy of application development excellence be successfully applied to developing and managing industry-specific applications?;
- ◆ trilogly continues to battle with the erp vendors – sometimes in competition, sometimes in partnership;
- ◆ new focus by trilogly on roi from software productivity encourages measurement of the effectiveness of using front-end applications.

Overall, the five-level hermeneutic framework for the Trilogly case study provided a strong and comprehensive framework for capturing and extending dynamic sensemaking for Trilogly, for both the development of a pricing configurator application into a comprehensive front-end e-commerce application suite, in tandem with the rapid development of a small business into a robust medium-sized enterprise.

3. DSA model

The first DSA model was developed from a review of the whole Austin (1998) case study. The supporting note by Mandel & Austin (2000) was dropped from the analysis as it only addressed a list of new business ventures and not application development and delivery. The section in Austin's (1998) case study under "Developing the Product" was the main source for developing a DSA model (see Austin, 1998, p. 7-8). The paper discusses development philosophies, issues and approaches that could be regarded as distinctive to Trilogly. Figure 1 presents the original DSA model and is representative of Trilogly application development during 1996-1999.



Source: Austin (1998).

Fig. 1. Summary DSA Model for trilog application development (1998)

The application development commenced with the allocation of a “Product Idea” to a project team (box 2). A distinctive feature of Trilogy’s application development cycle is the concept of very small projects composed of 1-2 “Supercoders” (box 3). Trilogy’s management believed that one to two highly experienced and motivated programmers could do the work of 10-20 standard programmers. These Supercoders were given complete ownership of a project right through the whole application development cycle. Trilogy also believed in high levels of remuneration, bonuses and compensation, and ongoing training for the Supercoders, who were also accorded superstar status within the organization.

Components of the application were built or released as new development versions either on a nightly or weekly frequency. Updates to the development version were usually incremental (box 4). Components were integrated into the application weekly (box 5). A significant decision-point each week for the project team was whether a component or application would be likely to take longer than a weekly build cycle (box 6). If “NO” then the project team(s) can go onto new product development (box 7).

If “YES” then the project teams developed structured build release cycles incorporating decisions relating to new features and new releases (box 8). A set of collective decisions was made among a number of project teams working on application components or full applications, understanding that there were significant interdependencies between their projects. It is likely that this collective decision-making approach was actually incorporated into the application development cycle right from the commencement of the cycle. A full Trilogy Product Suite was released (box 9). However, that was not the end of the development cycle. Customers often required major customization of Trilogy’s applications into their own configuration systems (box 10).

A significant number of these customer requests added up to an extension of the application development cycle, whereby Trilogy rapidly prototyped a variation of the basic configuration software tailored for a customer request (box 11). The customized application was in effect a new version of the application and could be regarded as a completion point in the application development cycle (box 12). Trilogy’s application development cycle was supported

by a rapid decision-making system with a mix of very small groups (one to two coders) working in concert, with high collective empowerment, with a vision of an integrated application suite. There was provision for rapid customization beyond the basic application, which is worthwhile being viewed as part of the overall application development cycle. Interviews with Franke (2002) and Hyams (2002) confirmed the DSA model for Trilogy without any modifications for Trilogy's application development cycles up to 1999.

4. New DSA model (2001-2002)

The interviewees for the Trilogy case requested that a new DSA model be created for Trilogy's applica-

tion development cycles from 2001-2002. The new DSA model reflects Trilogy's commitment to vertical (industry) focused business management and product development. The interviewees provided substantial insights in the development of the new DSA model. Detailed product development cycle information was drawn from company documents on Trilogy Product Management Methodology, and is used but not directly referenced, with permission from the interviewees at Trilogy. These inputs were compiled into a vignette which is presented in Table 3 with the new summary DSA model presented in Figure 2 (see Appendix A).

Table 3. Trilogy's industry-focused application development

<p>Trilogy goes vertical – industry-focused enterprise solutions</p> <p>In 2000, Trilogy restructured from a horizontally focused application vendor toward using a Software Development Methodology designed to quickly conceptualize, create and deliver highly verticalized applications. Previously, from 1993-1999, Trilogy's application development strategies were based on Trilogy Product Roadmaps.</p> <p>The Executive Team established an Operations Group with five vertical divisions focused on key enterprise customers and products:</p> <ul style="list-style-type: none"> ◆ Automotive. ◆ Computer. ◆ Telecommunications. ◆ Financial services. ◆ New business. <p>Trilogy has a two-dimensional matrix of management and delivery resources, located in Core company-wide Groups and within each Division with deep industry experience. These resources cover:</p> <ul style="list-style-type: none"> ◆ General managers plus functional vice-presidents. ◆ Consulting. ◆ Human resources. ◆ Finance. ◆ Solutions marketing and business development. ◆ Product management and presales resources. <p>Trilogy's Fast Cycle Time (FCT) Software Development Methodology is now based on delivering vertical applications within industry Maps set up for each division for a two-year timeframe. There are four phases in this methodology:</p> <ol style="list-style-type: none"> 1. Product ideation <p>During this phase, Trilogy's division managers with their Solutions Marketing and Product Marketing teams generate ideas for products, create a vision for the product and the Industry, apply an investment justification process to the vision and product, and develop an Industry Roadmap supported by a Business Case. All product conceptualization and development are driven with a vertical industry focus.</p> 2. Product planning <p>During this phase, the capabilities of the product will be identified and sequenced for delivery. Product features will then be expanded into actual development schedules including actual release features and initial estimates release dates. During this phase, Product Management takes over with Development Teams in driving product planning.</p> 3. Product development <p>This phase consists of gathering the detailed requirements for the product, and commencing development using Trilogy's Fast Cycle Time methodology. Although Product Management and Development Teams are driving the product development process, chartered customers associated with specific Trilogy divisions may be involved in testing early versions of the product.</p> <p>An extended version of step in Trilogy's Software Development Cycle is outlined below:</p> <ol style="list-style-type: none"> 1. Identify and define product concepts (product ideation): <ol style="list-style-type: none"> a) industry analysis; b) analysis against current Trilogy industry/product maps; c) driven by solutions marketing/product management; some input from division general management. 2. Evaluate product concepts (product ideation): <ol style="list-style-type: none"> a) product vision and product concept; b) validate product concepts against industry maps; c) develop business case; d) driven by solutions marketing/product management; division general management.

Table 3 (continued). Trilogy's industry-focused application development

3.	Sequence capabilities and define product features (product planning):
	a) define and sequence product capabilities;
	b) product features against industry maps;
	c) driven by product management with input from development teams.
4.	Create release definition (product planning):
	a) determine release features and scope;
	b) determine resources and time estimates;
	c) define release review cycles;
	d) agreed and finalized between product management; development teams; division general manager; some input from nominated "Charter customers".
5.	Define release requirements (product development):
	a) identify potential product requirements;
	b) prioritize based on business value & decide on release contents;
	c) requirements inputs (from consultants);
	d) development release plan;
	e) undertaken by product management; development teams; some input from nominated "Charter customers".
6.	Develop Product (product development):
	a) iterative development via feedback and short development cycles;
	b) product locked once release to beta;
	c) iterative updates;
	d) develop launch development plan at beta stage;
	e) active involvement from product management; development teams; solutions marketing (for product roll-out and marketing); feedback from nominated "Charter customers" associated with testing.
7.	Release product (product delivery):
	a) product release certification process;
	b) certification for specific platforms;
	c) marketing launch;
	d) driven by development team; solutions marketing.
8.	Monitor product (product delivery):
	a) support including bug fixed and minor enhancements;
	b) feedback from installed base;
	c) set up for new products and/or next release;
	d) directed by product management with product fixed and sub-releases completed by development team.

Source: Hyams, Chris (2002a & 2002b).

Trilogy's industry-focused approach to application development is evident at the commencement of the application development cycle as all product concepts that are identified and defined subject to rigorous industry analysis (see box 2). Solutions Marketing and Product Management are responsible for the decision-making associated with mapping concepts against existing Trilogy industry and product maps.

Industry Group General Managers with Solutions Marketing and Product Management conduct further validation of concepts against industry maps and develop business cases for the concepts (box 3). Product concepts are transformed into actual product features and capabilities by Product Management (box 4). The defined product features are validated against industry maps, reinforcing that each of the Trilogy industry-based business divisions are directly involved in specific application development. Several groups are involved in creating a Release Definition, which includes release features and scope, resource and time estimates, and release review cycles (box 5). Product Management and the Project Development Team will create the actual documentation and content, but will consult closely with the relevant industry group General Manager for specific release dates. Selected "Chartered Cus-

tomers" will also be consulted, particularly with regard to product features and scope.

Trilogy's application development cycle has a specific step for the definition of release requirements which has more detail and further prioritization of product features than the release definition (box 6). There is an additional assessment of product features based on business value, and inputs from Trilogy and other consultants. Outputs from these assessments are then finalized into a Development Release Plan. Product Managers working with the Project Team and "Chartered Customers" drive the finalization of the Development Release Plan.

The actual product development phase is iterative and through short development cycles similar to the weekly/monthly build approach in the original DSA model (box 7). Product Management works with the Project Team, but also includes Solutions Marketing in this phase. The direct involvement of industry-based solutions marketing persons in the actual product development phase is a distinctive feature of Trilogy application development cycle, when compared with other software houses in this project.

A distinct beta product milestone occurs where product features are locked in and a Launch Del-

opment Plan is developed (box 8). There are still iterative updates based on testing the product at this stage. Product Management, with the Project Team and Solutions Marketing, are all active in beta testing and creating the Launch Development Plan. Trilogy has formal processes for product release (box 9). Trilogy's products are formally certified for actual release and for specific platforms (specific operating systems and/or vendor's computer systems). A formal marketing launch occurred for the product release. Certification processes are driven by the development teams, while solutions marketing drive the marketing launch.

Trilogy has formal post-release processes for product monitoring, including bug fixes and minor enhancements (box 10). Customers provide feedback on product performance and recommended fixes. Product Managers oversee product monitoring and take inputs for setting up the next application development cycle. The new DSA model represents a significant departure from the original DSA model in that it recognizes that almost all application development is undertaken within the Business Divisions and is focused right from conception on the industry map. Business requirements are focused within that Division, rather than being a generic application that was customized at the end of the application development cycle.

There are still some application development inputs from Trilogy executives in charge of development, but that is rapidly contextualized into industry/division-specific decision-making processes. The new DSA model still reflects an internal focus for applications required for Trilogy's own application development. However, there is a significant third-party interaction between Trilogy and selected "chartered customers" and consultants.

5. Events chronology map

Austin's (1998) "Trilogy (A)" case study provides a chronology of the genesis and rapid growth of Trilogy from 1990 through to 1998-1999. An events chronology map was created incorporating key events during this period (Figure 3, see Appendix A). Additional symbols were employed for the map including the flowchart symbol for a delay or problem and a six-pronged box for a solution to the delay or problem.

Joe Liemandt recognized that, compared to other functions with large computer hardware companies, sales and marketing were relatively non-automated functions (box 1). Liemandt believed that software to assist with the configuration of complex computer systems could greatly contribute to cutting costs in the sales and marketing functions.

While at Stanford University, Liemandt, with some other students, began work on configuration software in 1990-1991 (box 2). Liemandt, Lynch, Jones, Porch and Carter set up Trilogy in 1990 (box 3). They sought funding from venture capitalists but were regarded as too young, and ended up leveraging their own credit cards up to almost half a million dollars (box 4). During 1991, Liemandt decided to move the new company to Austin, Texas, to be closer to his ill father (box 5). The move enabled Liemandt to more easily hire David Franke, who was an experienced and well-known software developer (box 6). Franke's strong reputation in software development was a contributor to Trilogy signing up Hewlett-Packard (HP) as a customer in March 1992.

Trilogy rapidly built on its success with providing a configurator solution for HP, through signing up new customers including Boeing, AT&T, IBM and Chrysler in 1992-1993 (box 7). Trilogy gained extra business development knowledge through the appointment of Joe Liemandt's father, Greg, as Trilogy's Chairman in 1992. Greg Liemandt had recently been a senior executive with GE and a Chairman of UCCELL. Trilogy turned down several venture capitalists' offers of funding, but chose other specific VCs to gain expertise on how to grow a company rapidly (box 8). By 1994, Trilogy had grown to 100 employees, having hired experienced development, consulting and sales managers (box 9). However, Trilogy's executives were struggling with establishing reasonable growth targets for the company – and when to go public (or to IPO), and where the company might go after an IPO (box 10). Through his father's links with GE, Joe Liemandt was able to confer with Jack Welch the well-known CEO of General Electric (GE) about these issues (box 11).

Welch advised that Trilogy not to establish a traditional organization structure, but to focus on hiring the best people to develop the best products. John Price was hired to set up the Trilogy University that would hire and train high-quality developers. Over the three years 1995-1998, Trilogy built a substantial customer base, while broadening its product line beyond configuration to cover all elements of sales and marketing (box 12). By 1998, Trilogy was generating revenues of over \$100 million, with over 400 employees whose average age was just 26 (box 13).

Also, through the period of 1993-1998, Trilogy moved toward end-to-end solutions, working with indirect channels partners such as system integrators (box 14). Expansion from "front-office" into "Back-Office" activities put Trilogy on a collision course with ERP vendors ("Enterprise Resource Planning")

vendors) including SAP, PeopleSoft, Baan and Siebel (box 15). During 1998, Trilogy's employee numbers doubled and were expected to double again in 1999 (box 16). Austin (1998) highlights several issues facing Trilogy's executive team for 1999, around continued rapid growth, broadening product offerings, maintaining product quality, and maintaining business success and a risk-taking development culture (box 17). Trilogy also needed to dramatically increase distribution of its products without adding fixed costs to its overall business model. It seemed that Trilogy had to stay on an exponential growth curve forever.

6. Updated events chronology map

The original events chronology map was validated during the interview stage without modification up to 1999, and includes reference to Mandel & Austin's (2000) Trilogy (B) case study. The map timeframe was extended to 2002, and, Figure 4 (see Appendix A) presents an updated events chronology map.

During 1998-1999, Trilogy strove to extend its product range toward a full enterprise-wide commercial-off-the-shelf (COTS) e-commerce suite (box 18), through the establishment of an indirect business unit. Trilogy attempted to partner with developers to rapidly extend its application suite. Trilogy also attempted to tailor its packages for easier use by developers. Vantage was noted as a key partner in 1998-2000.

Trilogy established various Internet spin-off businesses in car ordering, insurance ordering, appliance ordering and college hiring from 1999-2000 (box 19). These spin-offs leveraged off Trilogy's configuration application knowledge, or developer training skills, or from enterprising Trilogy programmers and executives, who wished to branch out into new business ventures.

However, by mid-2000, with the Internet "bubble" bursting, Trilogy closed or sold most of its Internet businesses (box 20). The indirect business unit was also abandoned, mainly because of the complexity of attempting to establish an extended COTS application suite. This experience reinforced a view within the company that developing a general COTS application suite just like the ERP suppliers was definitely not a path that Trilogy should travel on. Trilogy's own growth was halted and the company undertook major restructuring and consolidation into 2001. Trilogy's response to a falling information technology market was to restructure toward a vertical/industry focus in 2001-2002, creating five Business Divisions (box 21). Each Division man-

ages its own application development, consulting, marketing and its own business functions. The five Business Divisions created include Automotive, Computer/IT, Telecommunications, Financial Services, and New Business. Several issues emerging from the original and updated events chronology maps are explored further through cognitive maps.

7. Cognitive maps

Cognitive maps created for the Trilogy case study were designed to complement DSA models and events chronology maps through additional exploration of selected decision-making issues and contexts. Three sections were extracted from Austin's (1998) case study for further text analysis and creation of cognitive maps to complement the analysis presented in the original DSA model and original events chronology map.

The three initial cognitive maps created for the Trilogy case study addressed the following themes:

- ◆ early development (1991-1994);
- ◆ industry and competition;
- ◆ software development.

During the interview process, requests were put forward for an additional cognitive map reflecting updated insights from 2000-2001: Industry-focused application development (2000-2001).

The first cognitive map is an extended insight into the creation and early growth of Trilogy. The second cognitive map provides insights into industry competition. Part of the second map parallels Trilogy's early growth, but about half of the map focuses on Trilogy's competition as it rapidly grew between 1993 and 1999. The third cognitive map amplifies logic and philosophy behind Trilogy's distinctive application development methodology for 1993-1999, but is also relevant through to 2002. The additional cognitive map highlights insights into Trilogy's industry-focused application development in 2001-2002.

8. Cognitive map 1 – early development (1991-1994)

The cognitive map was developed from the "From founding to market leadership" section in "Company Background" section (Austin, 1998, p. 2-3 see Table 4). Figure 5 (see Appendix A) presents this cognitive map. The map covers insights into the identification of an opportunity in 1990 to automate activities within sales and marketing functions, onto addressing the opportunity through the development of a configurator application, and the creation of a start-up company. The map also provides insights into rapid growth of Trilogy through to 1994.

Table 4. Text extract – Trilogy – early development (1991-1994)

Liemandt had come to Stanford knowing he wanted to start a software company. As an undergraduate, he had spent many hours researching the industry and thinking about where the best opportunities might be. In an around school work, he did consulting to pay bills and to stay on top of the latest in information technology practices. Eventually, experiences from consulting clicked with the research.

It seemed to Liemandt that hardware vendors had difficulty delivering their products with the right equipment. His consulting clients frequently received computers with missing or incompatible components. Selling and delivery processes for these complex products appeared to be largely manual and fraught with error. This observation prompted Liemandt to analyze the income statements of computer product companies, comparing spending patterns with the degree of automation in each company function. What he found surprised him (see Table 1).

Companies typically spent only 8 to 10 percent on General and Administrative costs, which had been extensively automated over the years. Research and Development, also highly automated in most high-tech companies, accounted for slightly more spending, about 10 to 15 percent. Manufacturing was a similar story: mature cost saving technologies had been applied to reduce spending (less cost of good sold) to 20 to 25 percent of the firm's total expenses. What remained after deducting these major categories was more than 40 percent of expenditures that were mostly related to Sales and Marketing – an area which, surprisingly, was not very automated. If automation of the "selling chain" allowed companies to put an additional 12 percent of revenues on the bottom line (a number which Trilogy now considers reasonable), that would be worth literally billions of dollars. It was a potentially huge market that had not yet been targeted by anyone.

While still in school, Liemandt and the others had begun working on configuration software, which incorporated complex if-then rules into a tool that would prevent mismatches between incompatible product parts. They continued this work after school, into 1991, always sure they were on the verge of solving the configuration problem that would finally give them a completed product. Companies like Hewlett-Packard (HP) and Digital were working on their own "configurators", which added urgency to Trilogy's efforts. Liemandt presented their ideas to venture capitalists, but none would invest in a company composed entirely of barely 20-years-olds. To stay a float, the team leveraged more than 20 credit cards, managing to borrow almost half a million dollars in cash advances. Liemandt describes the mood in the days before the company had revenues or product:

At the beginning, nothing worked. We lived failure every quarter. The product never worked. We'd sit around thinking "This is just ridiculous, why are we continuing?" We were living in a state of failure, but we had this hope, this shining star that wouldn't go out. What kept us together was the vision that this was a huge opportunity; we just needed to make it work. That, or the fact that we were yelling at each other the whole time.

In 1991 the company moved to Austin, Texas so that Liemandt could spend more time with his father, Georgy Liemandt, who had been diagnosed with a fatal illness. By this time Trilogy had an early product and had applied for patents covering its algorithms, but the company still had no customers. They were working hard to generate interest in their software, but nothing was working. HP, a key potential customer, sent a particularly discouraging letter saying, in essence, "We already have a configurator and don't need your product".

Meanwhile, however, being in Austin enabled Trilogy to hire David France, a software developer with an industry-wide reputation, from a research consortium in Austin. With France on board, the company suddenly had new-found credibility. Silicon Graphics became the first customer, signing a small deal. Within months, HP was back, this time offering \$ 3.5 million for software and support services. The deal was consummated in March of 1992. At the time, Trilogy had eight employees.

When HP signed, everything changed for Trilogy. Software that was good enough for HP was good enough for a lot of other big companies, also. The floodgates opened and Boeing, AT&T, and, eventually, IBM and Chrysler became customers (the IBM deal alone was worth \$25 million). Also significant: Liemandt's father, a former GE executive and chairman of UCCELL, who had called his son a moron for squandering his Stratford education, greed to become Trilogy's chairman, a position he needed the expertise on how to grow a company that those firms could offer. Venture investors who had refused to fund Trilogy in the early days came calling – and were turned a way. Liemandt retained more than 50 percent ownership.

As orders rolled in, Trilogy staffed up. The company grew rapidly to around 100 employees. They hired experienced executives to head development, Consulting, and Sales. But by late 1994, Liemandt was not happy with the things were going. Things were good at present, but he worried about the future.

Some of the factual material in this section was found in "Dream On", by Karen E. Starr, *Selling Power*, October, 1997, Vol. 17, No. 8; and "Holy Cow, No One's Done This!" by Josh McHugh, *Forbes*, June 3, 1996.

Source: Austin (1998, pp. 2-3).

While studying at Stanford University, Joseph Liemandt wanted to start up a software company. He had unearthed an opportunity where computer hardware vendors had difficulty delivering products with the correct parts and equipment. Their selling and delivery processes were mainly manual, and were error-prone. Liemandt conducted further analysis on the income statements of selected computer companies, finding a breakdown of costs into the following percentages:

- ◆ General and Administration (G&A) (8-10%).
- ◆ Research and Development (R&D) (10-15%).
- ◆ Manufacturing (20-25%).
- ◆ Sales and Marketing (40%).

G&A, R&D and Manufacturing had been extensively automated, but by 1990 there was very little automation within sales and marketing functions.

Liemandt calculated that attempting to automate aspects of the "Selling Chain" (the sales and marketing functions) to enable an additional 2% of revenues would be potentially worth billions of dollars – and was a new potential market not currently targeted by anyone. Austin (1998) indicated as an ad-

ditional note that the estimate of adding 2% to revenues was a figure considered as reasonable by Trilogy. Liemandt and some other students at Stanford started work on developing configuration software. Configuration software enables the user to incorporate all essential features and equipment for a product, plus nomination of optional additional products and accessories.

In the late 1980s, most quotes for computer hardware were line-by-line items manually entered without any form of validation or checking. For complex large system quotes, such as for multimillion dollar tenders, hardware consultants were employed to check system configurations and line-by-line. The author of this dissertation was a specialist consultant in the area of the configuration and pricing of complex computer systems in the late 1980s.

Early configuration systems were developed by DEC and HP in the mid-to-late 1980s, but they both required mainframe computer power to run through complex if-then rules, and even then only standardized systems with few additional options could be processed into quotes in a reasonable turn-around

time. Nevertheless, as minicomputer and small server performance was rapidly increasing, these configuration systems had the potential to be placed on smaller very powerful UNIX-based systems emerging at that time, and eventually on Windows-based PCs.

Liemandt realized that Trilogy needed to bring its configuration software to market quickly to counter DEC and Hewlett-Packard's early lead. Decision-making at this stage was all about evaluating options to commercialize and bring to an application rapidly to market. Trilogy needed capital to accelerate application development. Liemandt sought venture capital support but no venture capitalist was prepared to invest in a company with such a young group of developers. However, Trilogy's founders had such a strong faith in its capability and vision for its application that they leveraged its own credit cards with cash advances of almost half a million dollars. Such an attitude to risk-taking, that is, risk enough money to hurt, but not to break the bank is a fundamental organizational value at Trilogy and is explored in more detail in other sections of Austin's (1998) case study.

Liemandt described the atmosphere of Trilogy at the time (1990-1991) as a state of failure where nothing worked, but a strong vision kept the team together. Or the team seemed to stay together by "yelling at each other the whole time". A "circuit-breaker" for Trilogy seems to be Liemandt's decision to move Trilogy to Austin, Texas, in 1991. Liemandt wanted to spend more time with his ill father in Austin and moved there prior to his graduation from Stanford. Other members of the Trilogy gradually moved to Austin, some before graduation, some after graduation.

By the time the move to Austin was completed, Trilogy had developed an early application. In an unusual move for software developers, Trilogy applied early for patents – not so much for the actual application but for the algorithms used in the if-then rules within the application. Although Trilogy was trying hard to generate interest in its application, they had no customers. In a twist suggesting Trilogy knew that its application was superior to Hewlett-Packard's existing configuration software, Trilogy was actively targeting Hewlett-Packard as a potential customer. At the time, Hewlett-Packard rejected Trilogy's overtures, claiming that it already had its own configuration software.

Moving Trilogy to Austin enabled Liemandt to hire David Franke from a research consortium in Austin in 1992. Franke was a well-known software developer with strong links to various hardware and software suppliers and he gave Trilogy a substantial boost in industry credibility. Trilogy's increased industry credibility through Franke

translated into new customers. Silicon Graphics (SGI) became Trilogy's first customer, and within a few months Hewlett-Packard signed up in a \$3.5 million deal for software and support services. Trilogy was still a small start-up company with eight employees, facing exponential demand for its application.

Securing Hewlett-Packard as a key customer appeared to legitimize Trilogy in the eyes of several large companies who soon also signed up with Trilogy – and for large contracts. Boeing, AT&T and Chrysler rapidly signed up, while IBM took on Trilogy's software and support for over \$25 million. Liemandt's father Greg, although diagnosed with a fatal illness, was appointed Chairman of Trilogy during 1992-1993, sharing valuable experience and knowledge from senior executive roles at GE and being Chairman at UCCELL. Trilogy now needed knowledge and resources to turn into a large enterprise servicing large corporate customers.

Trilogy was seen in this period as a great investment opportunity by several venture capitalists, but most were turned away as Liemandt really wanted expertise and resources to rapidly grow the company, and not just capital. Liemandt accepted funding from two venture capitalists that provided these additional benefits, but maintained 50% ownership of the company. Trilogy grew rapidly through 1992-1994 to around 100 employees and experienced executives were hired to establish organizational structure for development, consulting and sales. Trilogy was growing strongly with a "killer application" for sales & marketing – and that was all before the Internet revolution arrived.

9. Updated cognitive map 1 – early development (1991-1994)

The cognitive map was revised through direct editing in PowerPoint with inputs from interviews with Franke (2002) and Hyams (2002). Several sections of the original map were validated with minimal changes, but there were some significant additional insights for other sections. Figure 6 (see Appendix A) presents the updated map. Sections 1 and 2, apart from some formatting adjustments, were validated unchanged from the original cognitive map. Section 3, on "early configurator application development", was updated to indicate that apart from Liemandt, the other early developers were Chris Porch, John Lynch, Tom Carter and Christy Jones. The actual configuration application was known as SalesBuilder and was based on an expert system with neural network capability. These features enabled the

setting up of complex rules for selection of features and options.

Section 4 was validated unchanged from the original map. Trilogy's move to Austin covered in Section 5, was amplified to provide more insight into Franke's move to Trilogy. Franke had worked with MCC in Austin, a company that was focused on developing new computing technologies and software. Franke had substantial knowledge in software development, expert systems and he was already quite familiar with algorithms and developments related to configuration applications. Franke helped Trilogy formalize SalesBuilder into a formal release SalesBuilder V1.0.

Section 6, on New Credibility and New Business, was updated to incorporate additional insights.

Trilogy had eight employees in March 1992. Trilogy developed SalesBuilder V2.0 in mid-1992, using its own code and developers. NCR was identified an additional large new customer in 1992. Section 7, covering Rapid Growth, was validated unchanged except that Joseph Liemandt became chairman in late 1993 (after his father Greg).

10. Cognitive map 2 – industry and competition

The cognitive map was developed from the "Industry and Competition" section in Austin (1998, pp. 4-5 – see Table 5. Figure 6 (see Appendix) presents this cognitive map. The map provides a cognitive description of Trilogy's perception of its competition and industry space from the early 1990s to 1999.

Table 5. Text extract – Trilogy – industry and competition

<p>Industry and Competition</p> <p>Liemandt's original analysis of spending patterns versus degree of automation in computer product firms had identified a wide-open market worth at least \$10 billion. The few companies that were in that market at the time were bit players, selling things like contact management software for salespeople. Most of the functionality that constitutes the bulk of the "selling chain" – catalog updating, configuration, pricing, bid preparation, commission calculation – was performed manually or by software written by product firms themselves. Trilogy had pushed rapidly and successfully into this mostly empty space.</p> <p>But Trilogy's success did not go unnoticed. Beginning in about 1993, new companies like Aurum, Brightware, Calico, Clarify, Remedy, Scopus, Siebel System, and Vantive entered area of sales and marketing automation. Some of these companies targeted niches that were not in immediate competition with Trilogy. But all were operating in the same general space, going after that 40 – plus percent of P&S spending that Liemandt had first noticed as a student. More worrying than these small players, however, was the awakening interest of the giants of Enterprise Resource Planning (ERP) – rapidly growing companies that were many times larger than Trilogy, such as SAP, Oracle, Peoplesoft, and Baan (see Figure 1 for profiles of these companies, see Appendix A).</p> <p>Trilogy had intentionally positioned itself as an "enterprise software" company, meaning that its products were designed to work together to provide end-to-end functionality for a major segment of a customer's business (see selling chain). This was necessary because Trilogy's corporate customers were increasingly looking to build or buy integrated systems. Companies that did not sell enterprise products risked losing out to companies with more integrated and broader product offerings. But ERP vendors saw the enterprise software market as their turf. One company's supply chain, reasoned the ERP giants, was another company's selling chain. As the experts on integrating a customer's "back office" – the value stream from procurement through production to delivery – it seemed only natural to the ERP vendors that they should also integrate the "front office" – the selling chain. Liemandt summarized the threat to his company in stark terms:</p> <p>They decided that Trilogy had done some fantastic research for them and that they'd just come in and take it over. The question was (and still is), "Can we withstand the onslaught of giants ten times as big who want to move into our space?"</p> <p>As early as 1993, Trilogy had realized that the number one threat to its long-term well-being was SAP, the largest of the ERP vendors, which by 1998 owned 70 percent of the back office automation business for Fortune 500 customers. In 1997 and 1998, the threat from SAP and other ERP vendors became more immediate. Baan purchased Aurum. Peoplesoft announced partnerships with Vantive and Siebel System (which itself bought Scopus). SAP pointedly failed to invite Trilogy to exhibit at Sapphire 1998, the Sap-sponsored tradeshow for its own customers, even though the company had participated in earlier years. At that same tradeshow, Hasso Plattner, SAP's chairman and cofounder, announced to his customers that 80% of the company's R&D going forward would be aimed at building front office products.</p> <p>Trilogy had a considerable head start on ERP vendors in the development of key technologies, especially configuration software, some of which was by then protected by patents. But the protection provided by patents would be short-lived. Whether Trilogy would remain a factor would depend far less on past accomplishments than on what they could accomplish in the future.</p>

Source: Austin (1998, pp. 4-5).

Liemandt identified an unmet market opportunity (see also first cognitive map) that he estimated to be at least \$10 billion in the area of the sales & marketing functions, or the "front-end" or "front-office" or the "selling chain".

Most activity in the selling chain activities for computer hardware companies such as catalogue updating, configuration, pricing, bid preparation and sales/consulting commission calculations were processed manually. There were a few companies that sold software for specific activities in the selling chain such as contact management software. There were some forms of simple customer database applications available for direct

marketing programs but CRM as a concept emerged in the late 1990s.

Trilogy was one of the first companies with a solution that went further than just one component of the "Selling Chain". However, it was not long before Trilogy faced competition from several fronts. Several of the companies that we would now see as CRM vendors were created in the early 1990s. Eight companies are noted in the original cognitive map, of which probably Siebel Systems is best known for sales force management applications.

Most of the companies noted were not in immediate competition with Trilogy – but they all could be classified as competition, depending on how an industry

space for a “selling chain” was defined. Trilogy faced more aggressive and powerful competition from a different front. Trilogy’s executive always saw the company as an “enterprise software” company that could address a full end-to-end “selling chain”. Trilogy was in part responding to customers who wanted to build or buy systems that at least integrated the selling chain. Such positioning put Trilogy directly in the path of large and rapidly growing enterprise resource planning (ERP) vendors. Companies such as SAP and Oracle had been established at least 10 years longer than Trilogy and had grown rapidly through the 1980s and 1990s offering various key enterprise applications.

SAP had grown out of offering enterprise financial software, expanding into manufacturing and logistics in the early 1990s. SAP could be put on several computer hardware platforms but was often used on IBM systems through the 1980s and early 1990s. Oracle rode the Open Systems/UNIX boom of the late 1980s and early 1990s to be the major database application for various enterprise applications to run on UNIX hardware vendors including Sun, Hewlett-Packard, and DEC’s UNIX systems. Oracle was also early to position its applications as e-business solutions to work with the World-Wide Web. Peoplesoft was created in the late 1980s with Human Resource Management (HRM) applications but spread quickly into other enterprise applications, working closely with UNIX computing vendors, but also with IBM and DEC’s VMS systems of the early 1990s. Baan was a Dutch company that emerged through enterprise financial applications in the early 1990s.

The ERP companies’ main focus was integration of “back-office” activities such as manufacturing, logistics, and financial management. However, it was logical for the ERP companies to expand its application suites right from procurement to delivery, including integration of front-office activities. Trilogy identified SAP as its number one long-term competitor as early as 1993. SAP dominated the “back-office” ERP business with about 70% share of that business by 1999. However, for about five years Trilogy worked with SAP as a key ISV and regularly exhibited at Trilogy’s main tradeshow, SAPPHERE.

SAP changed its strategy in 1998 to focus heavily on building front-office applications. One side-effect of that strategy was not to invite Trilogy to SAPPHERE 1999. At that event SAP’s Chairman committed that 80% of SAP’s R&D would go to development of front-office applications. By 1997, competition between the main ERP vendors and Trilogy was quite direct, as a number of ERP companies either acquired ISVs with front-office applications, or they attempted to develop their own applications.

Trilogy’s management believed that the company possessed a considerable lead over the ERP vendors in the selling-chain area. Trilogy was very strong in configuration technology, for which it held some significant patents. However, Trilogy needed to continually develop new front-office-related applications and grow fast enough to gain sufficient critical mass to take on much larger companies pushing into the selling-chain space. Liemandt directly questioned whether Trilogy could survive as a key player at least in the selling chain industry that he had defined back in the early 1990s.

Liemandt was reflecting on a not uncommon problem for small start-up companies with strong new technologies facing up to larger more established companies attempting to break into its area of expertise. Other case-studies in this project and particularly those with enterprise software solutions have faced the same problem as Trilogy’s.

NetDynamics gained a strong early lead with its application to link WebPages with databases, but was then acquired by Sun, as it needed size and resources to support a rapidly growing enterprise customer base. Kana rapidly acquired ISVs to develop a full e-CRM solution. It moved from a focused application on e-mail communication management to a redefined and more integrated e-CRM and e-commerce applications space.

Trilogy could see that they needed to at least strengthen its product offering for the selling chain, although at the same time, it was not committing to redefine its offerings to match the total ERP solutions. The overall cognitive map presents Trilogy’s management perceptions of competitive evolution through the 1990s. The map also highlights Trilogy’s executive team’s strategic mapping of its competitive position, initially in a new industry, but then in a more broad and redefined industry with much larger and more aggressive competitors on the same perceived turf.

11. Updated cognitive map 2 – industry and competition

The cognitive map was revised subsequent to interviews with Franke (2002) and Hyams (2002) (Figure 8, see Appendix A). Most of the original cognitive map was validated unchanged, but there were some additional insights and structural updates incorporated into the map.

The first section of the map covering “Early 1990s – Wide-open Market” (box 1) was validated with only two modifications. The first indicated that Trilogy released an application Selling Chain V1.0 in 1994-1995 with the functionality described in the original map. The second modification was the incorporation of the comment in the original map relating to

Trilogy’s moving into a mostly empty space, into the first section of the updated map. The second section, “Mid-1990s – New Companies Enter New Sales & Marketing Automation Market”, was validated with two modifications related to the same point. Franke (2002) noted that there were two or three vendors in the configuration space. Trilogy’s competitive advantage was based on the breadth of its new application suite (Selling Chain V1.0) and better point-by-point configuration capability. The third section on emerging ERP companies as potential competitors was validated unmodified, but extended to highlight the ERP vendors’ strengths in Financials, Human Resources Management and Manufacturing suites.

Trilogy’s positioning as an “Enterprise Software Company” (box 4) was validated without modifications to content, except that the sub-section on ERP vendors seeing enterprise software as its turf was reformatted into a separate section (box 5 – ERP Companies Move From “Back-Office” to “front-office”). The original section on SAP being the Number One threat to Trilogy was slightly reformatted (see box 6) but content was validated without modifications. An additional point was incorporated into the section indicating that, even by early 2002, SAP had still not delivered a complete Pricing and Configuration application similar to Trilogy.

The section on the consolidation of ERP Vendors with other “front-end” vendors through selected acquisitions was validated unchanged for content. However, this section, including the subsections on Liemandt’s view on the threat of from the ERP companies, and Trilogy’s competitive advantages over them, were split into three sections (see box 7 for Direct Competition, box 8 for Liemandt’s view of the ERP companies, and box 9 for Trilogy’s Competitive Advantages over the ERP Vendors).

The question at the end of the original map regarding whether or not Trilogy would remain a factor in the industry was reformatted as box 10. The revised cognitive map largely validates the original map, with some extra insights specific to Trilogy’s actual Selling Chain application suite.

12. Cognitive map 3 – software development

The cognitive map was developed from the “Developing the Product” section (Austin, 1998, pp. 7-8 – see Table 6). The cognitive map is presented in Figure 9 (see Appendix A). The map provides further insights into Trilogy’s product development capability and its fundamental philosophies of software development.

Table 6. Text extract – Trilogy – software development

<p>Developing the product</p> <p>Trilogy’s marketing goals depended vitally on the company’s product development capability. Specifically, marketing objectives required that developers sustain the competitive advantage Trilogy enjoyed in configurator technology while dramatically broadening the product to fill the enterprise needs of large and small customers in a variety of industries.</p> <p>Trilogy aspired to maintain a software development capability that was second to none. Their comparison set for evaluating themselves in this area was not their direct competitors, but other world class development organizations, especially Microsoft. In their aim to be the best, they believed that they had largely succeeded. Liemandt was convinced that no other enterprise software vendor was even a close second to Trilogy in development capability. Scott Snyder, Trilogy’s Senior Development VP, estimated that 15 or 20 successful software companies could be built around the talent in Trilogy’s development organization.</p> <p>Central to the company’s development capability was the “rule of the super coders”, which held that one superstar programmer could do the work of ten average programmers. “Getting the most out of great developers”, remarked Snyder, “is one of the things Trilogy does amazingly well”. The development process was geared toward giving Trilogy’s superstar programmers the support and freedom they needed to produce great products. Snyder described some of the company’s fundamental philosophies of software development:</p> <p>Our development is based around four basic philosophies. Small teams, very small from a traditional development standpoint. We expect entire new products to be created by one or two superstar programmers you can count on to deliver great products quickly. Complete ownership of the product at the developer level from initial product requirements gathering through product support. We don’t have a separate change team that insulates the developers from the impact of producing poor quality products. Intense focus on automation in order to free the developers (or anyone else) from having to spend their time manually performing frequently repeated tasks like regression tests. Finally, a focus on incremental development model that allows us to deliver new functionality quickly and provides us with the flexibility to react to changes in the market quickly.</p> <p>A key feature of the development process was that it evolved to maintain in responsiveness to the market, becoming more structured as the product matured. As the product grew beyond a certain size, explained Snyder, maintaining responsiveness and high product quality depended on some key disciplines:</p> <p>The goal is to maintain your code at ship level quality on a weekly basis. When a developer drops code for a new feature or bug fix into the build, it must be accompanied by the appropriate suite of automated tests to validate that the changes work as expected. These tests are added to the existing suite and the entire set is executed every time the product is built, whether that was a weekly or nightly build.</p> <p>If you had to develop a feature that took longer than the weekly build cycle, you branch your development, develop the feature, develop tests, merge it all back into the main build, then rerun all the tests on the integrated code. In addition to the individual product tests, we also have automated system tests which test the interactions between products. The goal is to constantly improve the quality of the product as you increase its functionality. Again, a very incremental model. It’s awesome and brilliantly suited for an environment which requires you to react quickly to any new requirement or change in market direction as long as you maintain the quality discipline.</p> <p>As the product grew in complexity, programmers retained absolute freedom to add features in whatever way they saw fit, but they were obliged to maintain in quality. As interdependencies developed between different developer’s programs, the build and release cycle became more structured, with decisions being made about the timing of the release of new features on a features-by-feature basis. New features were scheduled around a plan that used 60 to 70 percent of Trilogy’s development capacity with the remaining 30 to 40 percent held in reserve for late breaking and urgent fixes.</p>

According to Austin (1998), Trilogy’s marketing objectives focused heavily on the company’s devel-

opment capability. Trilogy’s developers had the goal of sustaining its competitive advantage in con-

figuration software, but also to quickly broaden the product to meet the enterprise needs of a wide range of customers. Balancing leadership in their core competency with broadening the appeal of the product to more customers was a logical approach to the rapidly growing enterprise software market during the mid-1990s. Such an approach also required the rapid recruitment of large numbers of very highly skilled application programmers.

Trilogy was created as a company with a deep belief in aspiring to be the best software development company in the world. Trilogy initially benchmarked its emerging development capability against other world-class development organizations, but particularly Microsoft. By 1998, Liemandt was convinced that Trilogy was the best by a long way in software development capability. Trilogy's Senior Development Vice-President in 1998, Scott Snyder provided insights into Trilogy's view of itself as a best-in-class software development company. He regarded Trilogy's development organization as "awesome and brilliantly suited for an environment which requires quick reaction to new requirements or change in market direction, as long as you maintain the Quality Discipline" (Austin 1998, p. 8). Snyder also believed that Trilogy's development organization could be the basis for "15 or 20 successful software companies".

In order to grow and maintain a best-in-class software development capability, Trilogy encouraged a concept of "Super Coders", whereby one Superstar Programmer could do the work of ten average programmers. Trilogy focused on "getting the most out of great developers" through "giving them the support and freedom needed to produce great products". A focus on maximizing productivity from high-quality programmers, right through to linking its achievements through to marketing goals, is an unusual feature of Trilogy as an organization.

Trilogy's software development was built around four fundamental philosophies which Austin has recounted from Scott Snyder. Small teams, in fact teams of even one or two Superprogrammers developing entire applications (or at least modules of applications), follow logically from the very high value Trilogy placed on these individuals, both from a productivity and quality output perspective.

Complete ownership of the product at developer level is driven down to a unit of analysis of a team of one or two Superprogrammers. Trilogy gives its teams control of the full application development cycle – both for good and poor quality products. In reality the ownership is at a collective team level and this is evident where there are requirements to create new modules or new applications. Intense

focus on automation enabled Superprogrammers to be freed up from manually performing frequent repetitive tasks and to focus on direct application development. Focus on incremental development model seems initially to be a contradiction in that Superprogrammers might be expected to quickly create radical new applications and products. However, Trilogy seems to have placed a higher priority on sufficient modularization and break-down of development components to enable the Superprogrammers to quickly change components in response to fast changes in markets.

Applying the four fundamental philosophies of software development to actual development processes required balancing the need to maintain responsiveness to markets with becoming more structured as markets matured. According to Tom Snyder, maintaining this balance depended on some programming and development disciplines. Development teams should have a goal to maintain its actual code at a level where it could be shipped (or be certified as completed) on a weekly basis. A new component or feature or bug that was to be incorporated into the weekly build of the overall application had to include a set of automated tests that would validate that the addition would work as expected – outside and within the weekly build.

The tests would be executed every time a build was undertaken. While a typical build may be undertaken weekly, some applications were built into new versions nightly – with the tests having to run at the frequency of the build. Development Teams had to quickly judge if a feature or component or bug was likely to take longer than one weekly build cycle. Anything longer than the weekly build cycle prompted a branching of development, probably to a new or revised small team, which would undertake the development with the automated tests and then ensure that it merged successfully back into the overall application, usually in the next weekly build. Additional automated systems tests were created to test interactions between applications, modules and other Trilogy products. Trilogy focused on constantly increasing the quality of its overall product-line as it also increased functionality within the line.

Over time Trilogy's product grew in complexity and, while the Superprogrammers retained the freedom to add features, they had to maintain overall product quality. Interdependencies emerged across and between the development teams with more decision-making required across the teams.

Cross-team decision-makers contributed to increasingly structured build and release cycles, and all additional features were subjected to substan-

tial assessment before being accepted for both development and incorporation in the product. By the late 1990s, Trilogy's development processes had evolved to allocate 60 to 70% of Trilogy's development capacity for new features, and 20 to 30% in readiness for late breaking and urgent fixes. The cognitive map captures insights from a company that puts the very highest priority on best-in-class software development. There is literally a unique definition – and acclaim – of a “Supercoder” or “Superprogrammer” that is capable of much higher application development productivity than typical programmers. Trilogy pushes this elite group of programmers further with philosophies and supporting processes designed to maximize its productivity. Trilogy appears to have achieved scalability throughout the late 1990s, with its “Superprogrammer” approach, maintaining frequent releases and updates, with both high-quality shipment code and effective bug and quality fix processes.

13. Updated cognitive map 3 – software development

The cognitive map was validated almost unchanged through interviews with Franke (2002) and Hyams (2002), and is presented in Figure 10 (see Appendix A). The original cognitive map was validated unchanged except for the numbering of sections and for a comment from Franke (2002) that there were 20-30 small development teams during the late 1990s (this comment was added into the *Small Teams* subsection of “Four Fundamental Philosophies of Software Development”).

Franke (2002) and Hyams (2002) agreed that Austin's (1998) account of Trilogy's software development was accurate and with substantial insights – and these had been effectively captured in the original cognitive map.

14. New cognitive map 4 – industry-focused application development (2000-2001)

During the interviews for the Trilogy project, suggestions were put forward that both a new DSA model and supporting cognitive map for Trilogy's application development in 2001 be developed for the case study. The cognitive map was developed from a Subset from the “Trilogy Goes Vertical – Industry-focused Enterprise Solutions” Vignette (Vignette was presented in Figure 1, see Appendix A). The subset is presented in

Table 7, and Figure 11 (see Appendix) presents the cognitive map output.

From 1993-1999, Trilogy's focus was on excellence in software development, mainly in horizontal configuration applications. Trilogy had been servicing enterprise customers since its inception due to the nature of its configuration application and extensive potential for automation of key sales and marketing activities using the application and extended enterprise-oriented versions of it. However, in 2000 during and after the “dot.com” crash and falls in technology/computing stocks, the company restructured toward a focus on selected vertical industry sectors (box 1).

Trilogy revamped its software development methodology toward quickly conceptualizing and road-mapping applications against targeted vertical markets, thereby developing and delivering highly tailored applications for specific industries and customers. Trilogy's Executive Team established an Operations Group with five vertical divisions, based on its key enterprise customers and products (box 2). Trilogy's five divisions are Automotive, Computer, Telecommunications, Financial Services, and a New Business Division.

Each division was set up with a complete set of management and delivery resources (box 3). Each division possessed resources with deep vertical industry experience in all management areas, including General Management, Development, Consulting, Human Resources, Finance, Solutions Marketing and Business Development, plus Product Management. In terms of decision-making, Trilogy's restructure was a radical departure from decision-making focused at the Superprogrammer or at the small development team level, toward managers with deep industry experience – but not necessarily focused on software development.

Trilogy's software methodology is now based on delivering vertical applications within each Division (box 4). Each Division has its own industry maps set up for a two-year timeframe which is designed around a four-phase development methodology. The first phase of software development methodology is “Product Ideation” where Division managers, with solutions marketing and product marketing teams, work together on generating ideas and vision, which in turn are translated into products within the context of targeted industries.

Table 7. Extract from vignette – Trilogy’s industry-focused application development

<p>Trilogy goes vertical – industry-focused enterprise solutions</p> <p>In 2000, Trilogy restructured from a horizontally focused application vendor toward using a Software Development Methodology designed to quickly conceptualize, create and deliver highly verticalized applications. Previously, from 1993-1999, Trilogy’s application development strategies were based on Trilogy Product Roadmaps.</p> <p>The Executive Team established an Operations Group with five vertical divisions focused on key enterprise customers and products:</p> <ul style="list-style-type: none"> ◆ Automotive. ◆ Computer. ◆ Telecommunications. ◆ Financial services. ◆ New business. <p>Trilogy has a two-dimensional matrix of management and delivery resources, located in Core company-wide Groups and within each Division with deep industry experience. These resources cover:</p> <ul style="list-style-type: none"> ◆ General managers plus functional vice-presidents. ◆ Consulting. ◆ Human resources. ◆ Finance. ◆ Solutions marketing and business development. ◆ Product management and presales resources. <p>Trilogy’s Fast Cycle Time (FCT) Software Development Methodology is now based on delivering vertical applications within industry Maps set up for each division for a two-year timeframe. There are four phases in this methodology:</p> <p>4. Product ideation</p> <p>During this phase, Trilogy’s Division Managers with their Solutions Marketing and Product Marketing teams generate ideas for products, create a vision for the product and the Industry, apply an investment justification process to the vision and product, and develop an Industry Roadmap supported by a Business Case. All product conceptualization and development are driven with a vertical industry focus.</p> <p>5. Product planning</p> <p>During this phase, the capabilities of the product will be identified and sequenced for delivery. Product features will then be expanded into actual development schedules including actual release features and initial estimates release dates. During this phase, Product Management takes over with Development Teams in driving product planning.</p> <p>6. Product development</p> <p>This phase consists of gathering the detailed requirements for the product, and commencing development using Trilogy’s Fast Cycle Time methodology. Although Product Management and Development Teams are driving the product development process, chartered customers associated with specific Trilogy divisions may be involved in testing early versions of the product.</p>
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Source: extracted from Table 3.

Although there appears to be substantial freedom to visualize and conceptualize new applications in this early phase development, there is an immediate requirement to apply an investment justification process and to immediately map them to an industry roadmap with a business case. All product conceptualization and development are undertaken with direct alignment to specific divisional industry roadmaps, and thus is driven right from the outset with a vertical industry focus.

In the second phase of development, Product Planning, Product Management, with Development Teams (within each Division), drive the definition of product capabilities and scheduling of development and delivery (box 6). Product features are identified and defined into full development schedules with estimated and declared release dates. In the third phase of development, Product Development, Trilogy employs a proprietary application development methodology (Fast Cycle Time, or FCT), to quickly develop new features and applications (box 7).

Although the full four phase methodology is known as FCT, the actual product development phase is an

industry-focused evolution of Trilogy’s earlier software development methodology, using small teams of Supercoders with automated tests, as described in the cognitive map on software development.

Key customers (or chartered customers) for specific Trilogy divisions may be involved in the testing of early versions of a product. These customers may also have had some say in product ideation via consultants working with them and through to the Solutions Marketing Group. Trilogy commenced the development of Internet-enabled applications in 1996-1997 mainly using Java, C++ and new object-oriented developer applications, plus they were early adopters of XML. Trilogy’s configuration systems saw an almost immediate deployment into online ordering systems in 1996-1997 and have become one of the major enterprise-wide e-commerce applications. These applications are now growing strongly in all of Trilogy’s targeted industry segments through further customization and incorporation of new features and e-business technologies.

The final development phase, *Product Delivery*, commences when the product is beyond beta Re-

lease (box 8). Prior to final delivery, there is substantial collective interaction between product management, chartered customers, development teams and solutions marketing groups. A formal launch and roll-out of the product is finalized and the product is launched and delivered.

Ongoing product support and maintenance are classified as part of product delivery. Patches, bug fixes and sub-releases are planned and delivered within the product delivery phase. Further customization and support may be required through consultants working with customers on the deployment and installation of the new product. The cognitive map on industry-focused application development captures a radical transformation in decision-making associated with application development at Trilogy. There is a logical evolution of Trilogy’s small-team/Supercoder approach to actual application development, but it is now has strict boundaries and is focused toward targeted industries.

The new focus is further reinforced by the embedding of development resources, and most other management and operational resources, within specific industry divisions. The cognitive map (and associated DSA model) highlights an evolution for some software houses from a product-focused horizontal application and organizational development approach, toward a vertical industry-focused approach. Such an evolution may be relevant for software houses providing specialized enterprise-focused applications and is relevant for other case-studies in this project (Zaplet in particular also

moved from a horizontal to a vertical orientation during 2001).

On the other hand, some software houses in this project have preferred to remain horizontally focused even with its enterprise applications. Kana and NetDynamics/iPlanet have continued mainly as horizontally focused operations, although even in these cases there is increasing evidence of at least some broad vertical categorization of aspects of its products and services. Trilogy believes there is still great opportunity to further lower sales and marketing costs, and continues to develop new applications to address that challenge in the context of targeted industries.

15. Trilogy advanced case study 2003 update

Trilogy is viewable as an innovative enterprise e-commerce (also seen in the media as an e-business) application provider and, although beyond the scope of the current project, new initiatives such as linking customer ROI to its ongoing use of Trilogy’s applications could set the stage for further significant redefinition of what constitutes an “e-business” application suite (see Kirsner, 2002). Trilogy is also working on defining new measurements for customer satisfaction relating to enterprise e-commerce application suites incorporating business value metrics (see Sawhney, 2003).

During 2003, Trilogy packaged its Fast Cycle Time (FCT) application development methodology. FCT Web-based tools and supporting services are presented in Table 8 (see also Trilogy, 2003c).

Table 8. Trilogy – “Fast Cycle Time” (FCT) Methodology tools

<p><i>From methodology to reality</i></p> <p>Other project methodologies rely almost entirely on processes and organizational discipline. The Trilogy Fast Cycle Time methodology, however, includes a set of leading-edge, Web-based “vision management” tools for automating critical aspects of the methodology, along with managed hosting services that provide end-to-end quality and availability for FCT projects:</p> <p><i>Leadership.com</i> is a multimedia Web-based application that allows executives to record vision in a central location and makes the vision available to all project members.</p> <p><i>eFeedback</i> is a Web-based tool to elicit and consolidate user feedback, both on a Leadership.com site and on the target e-business Web site.</p> <p><i>ePrioritize and eRankIt</i> tool supports project-level triage of features and requirements. The innovative combination of philosophy and technology that underlies the Trilogy Fast Cycle Time methodology keeps both project and vision synchronized, providing a sound foundation for e-business project management.</p> <p><i>Managed hosting services</i> fully integrate the FCT methodology with computing, storage, and networking resources, providing a solid foundation of quality, availability, and administrative responsiveness required for FCT project success.</p> <p><i>Maximize business value with FCT</i></p> <p>The Trilogy Fast Cycle Time methodology offers a superior approach to managing and developing e-business solutions, one that maximized business value by constantly measuring progress and incorporating stakeholder feedback. To learn more about the FCT methodology, call the Trilogy Project Office at 1.877.292.3266 or send email to PMO@trilogy.com.</p>
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Source: Trilogy (2003c).

Packaging FCT for Trilogy represents the translation of fundamental application development philosophy and decision-making directly into a set of application management services – an unusual but very interesting offering over and above enterprise e-commerce application suites.

16. Research extensions

Additional insights were gained through placing additional questions within the DSA package addressing dominant logic, shared vision, leverage points, and strategic marketing issues. These questions were asked during the initial interviews and followed-up with further validation and commentary

in the follow-up interviews. Findings and discussion on these questions are not reported in this article but can be found in Woodside and Pattinson (2007).

Summary

Decision-making issues relating to software development at Trilogy from its inception in 1991 to 2002 were captured and mapped in a package of DSA models, events chronology maps and cognitive maps and extension questions. The Trilogy case study provides deep insight not just into software development and delivery, but also in the underlying philosophies behind developing and changing actual software development over time. The package also highlights a transformation for Trilogy from a horizontal product-focused organization through the 1990s to a highly focused vertical industry organization in 2001-2002. The interview process enabled extension of the case study timeframe to analyze Trilogy's transition in 2001-2002, in substantial detail.

Key insights from the case study include the following observations:

- ◆ transformation from product-focused to vertical industry-focused decision-making;
- ◆ underlying software development philosophies and their contribution to decision-making;
- ◆ decision-making associated with anticipatory competitive actions;
- ◆ defining and redefining product lines/application suites.

Summary – additional comments

The Trilogy case study highlights the decision-making associated with an organizational culture that exalts excellence in application development. DSA modeling augmented with events chronology and cognitive maps provides analysis and insights into rapidly building an enterprise application software house – and then transforming the whole organization toward a vertical industry-based focus.

The Trilogy case study explores the decision-making associated with combining a philosophy of “best-practice” application development with risk-taking in order to grow a company rapidly to prepare for an eventual and imposing competitive showdown with larger and more established corporations. The advanced case study also provides insights into decision-making from a big vision (automating enterprise sales & marketing activities) into a focused application offering (pricing configuration software) and onto a major provider of vertically focused (industry-focused) applications. The Trilogy case study offers some special contributions to the overall research project through analysis of

explicit philosophies on application development that appear to be as fundamental to the organization as growing a strong and profitable software powerhouse.

The creation and validation of a set of DSA models plus cognitive mapping outputs represent an effective mapping of strategic sensemaking over time and in multiple contexts. This extended DSA approach offers insights into turning an idea into an application in conjunction with turning a small start-up business into a substantial and competitive enterprise software provider. The analysis indicates that Trilogy's executive management team was driven to take substantial business and application risks in order to quickly reach a “critical mass” such that they could take on severe competition from much larger and more established ERP software houses. Both Trilogy and its “selling chain” competitors perceived that its niche would develop into a larger market for enterprise-wide application suites.

DSA models and selected maps for the Trilogy case provide unusual insights into a very strong logic for setting innovative application development processes and cycles. In fact, Trilogy branded its Fast Cycle Time (FCT) application development system.

Trilogy has a special system of recruitment and training to instill shared vision and empowered decision-making at the individual developer level in projects. The Trilogy case study offers mapping over time of decision-making associated with transformation from a “best-practice” product-driven business and application development approach into a vertical industry-focused business. The Trilogy case study provides valuable insights into establishing “best-practice” application development groups. Trilogy's strong organizational culture around “super-programming skills” capabilities and testing excellence through recruitment and training are explored in the case study. The interview process for the Trilogy case study provides valuable insights into transforming a software house from a strong product development focus across industry-focused business groups and application development.

Key strategic insights for management applications

The Trilogy case study provides special insights into a company with a very strong software application development culture – and its efforts to change to become a more market-focused business. Recommendations for management consideration and application include the following actions.

Managers should seek out, or develop, highly skilled software programmers. “Superprogrammers”, when effectively deployed, can dramatically speed up commercialization and time-to-market for

software applications. However, the Trilogy case also shows that deployment of superprogrammers without appropriate strategic focus is not necessarily a formula for business success either. Some form of directed market or customer focus is required to facilitate such supercharged development teams.

Sometimes there are opportunities to turn exemplary development processes into products or consulting services. Trilogy turned its fast cycle time (FCT) methods into a product and consulting service. Where a company has such strong product or application or service development capabilities, managers should explore scenarios for turning them into effective products and services.

Businesses should explore scenarios where the big players will counterattack, as Smart companies growing quickly in a larger company's perceived space will eventually face-off against the "Goliath"

in that space. Managers should explore ways to either make their product, service or technology so disruptive that the larger incumbent cannot meet the challenge, or to grow quickly enough to be able to continue to beat the larger player in niches that suit the start-up.

When can an ongoing proprietary application development keep winning? Is a full proprietary development approach actually now sustainable? Can organizations afford to wait to build capabilities in-house, or should they work more with third-parties to gain capabilities faster? Managers need to explore present and potential mixes of proprietary and third-party development for their application and service offerings. Then they can craft the vision with the best prospects of supporting development and delivery of disruptive technology.

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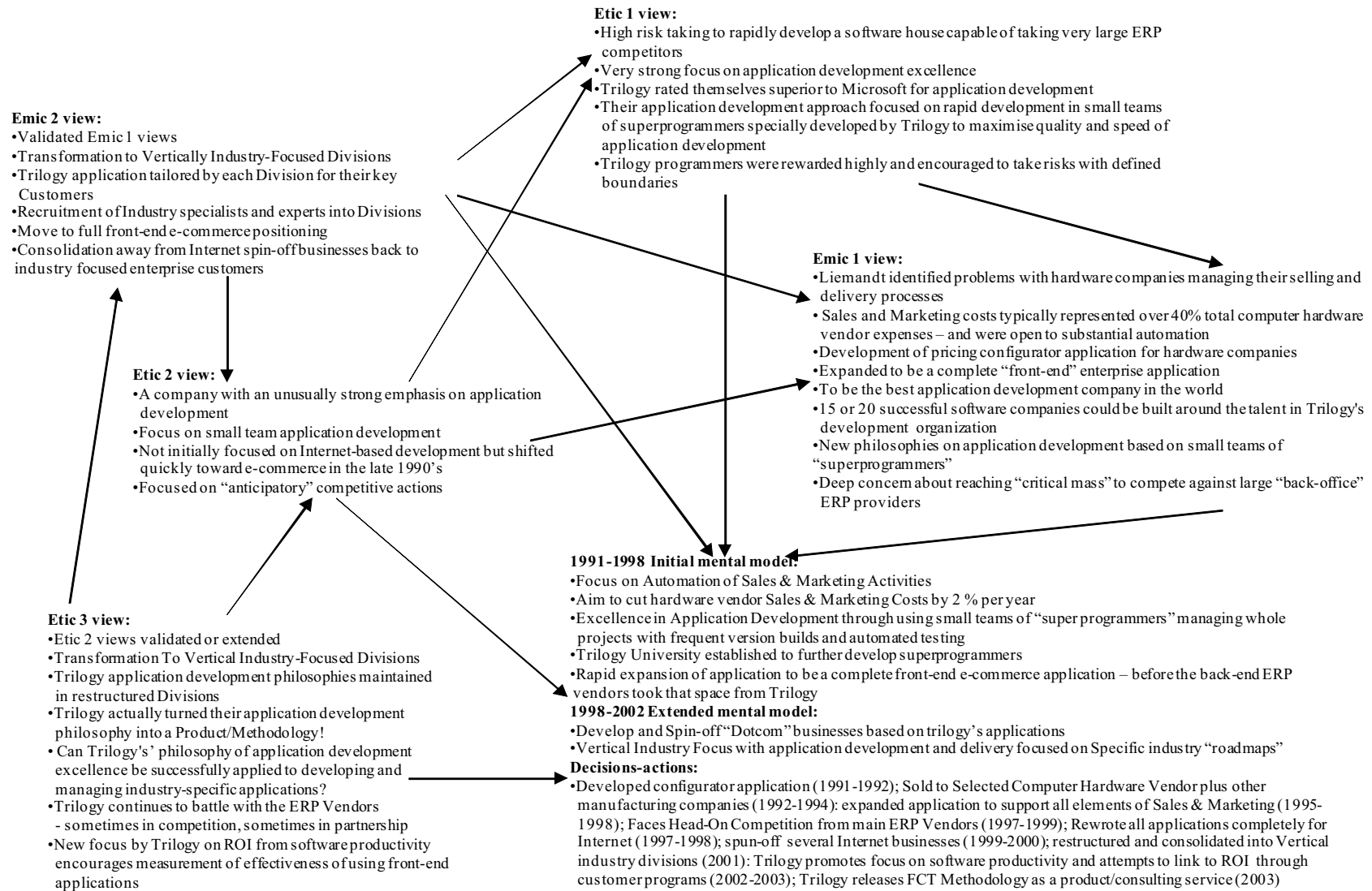
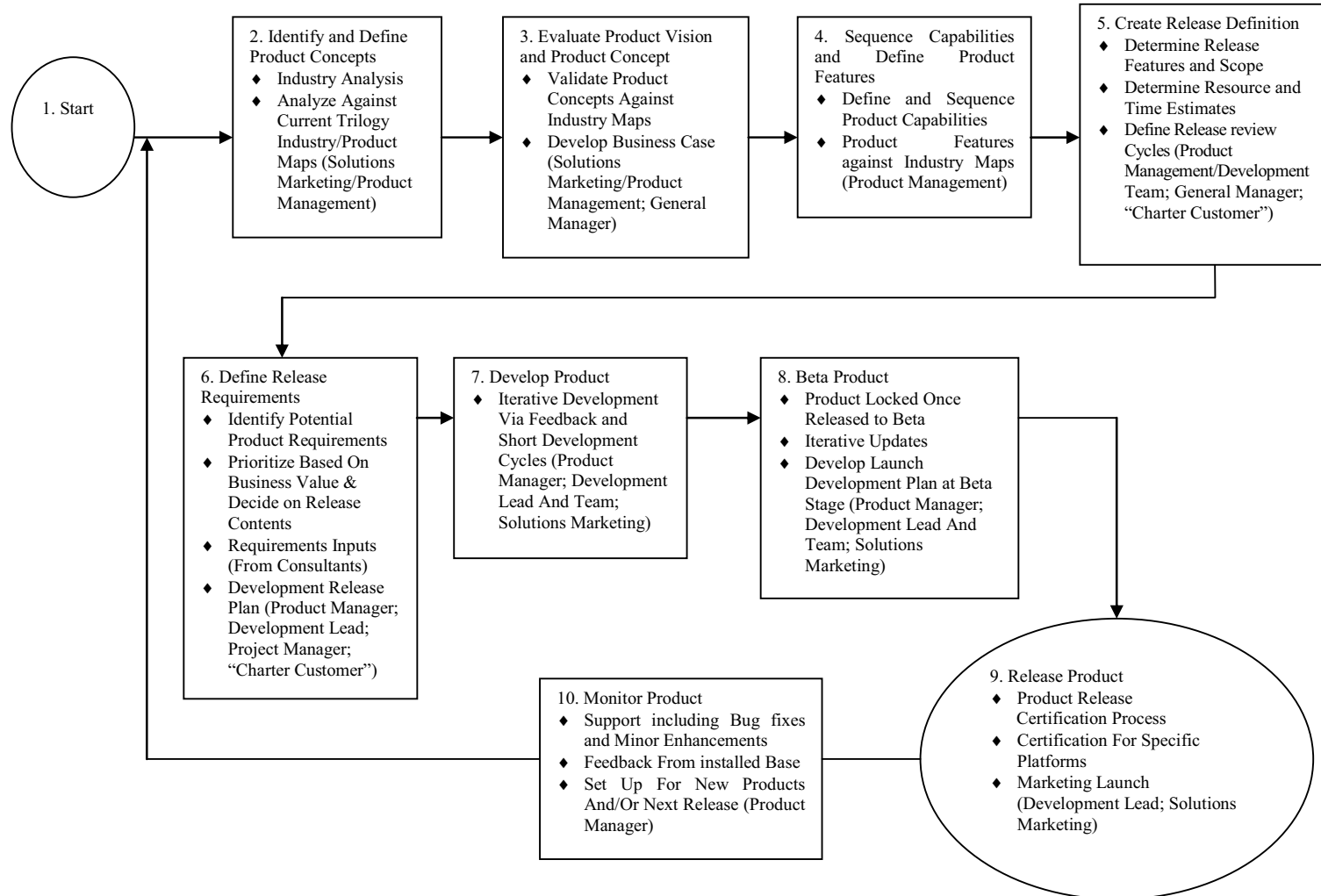
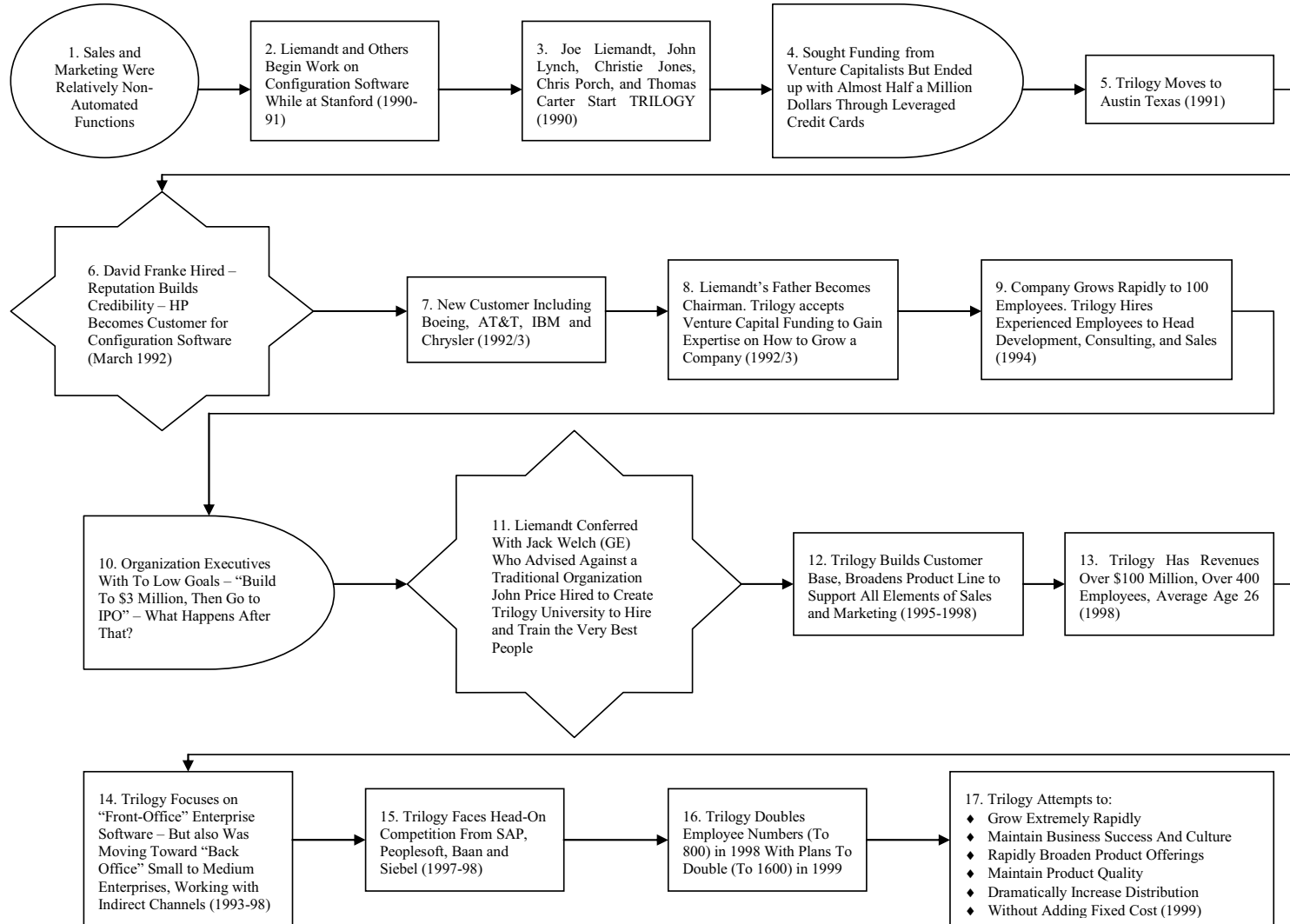


Fig. 1. Level V analysis of Trilog case



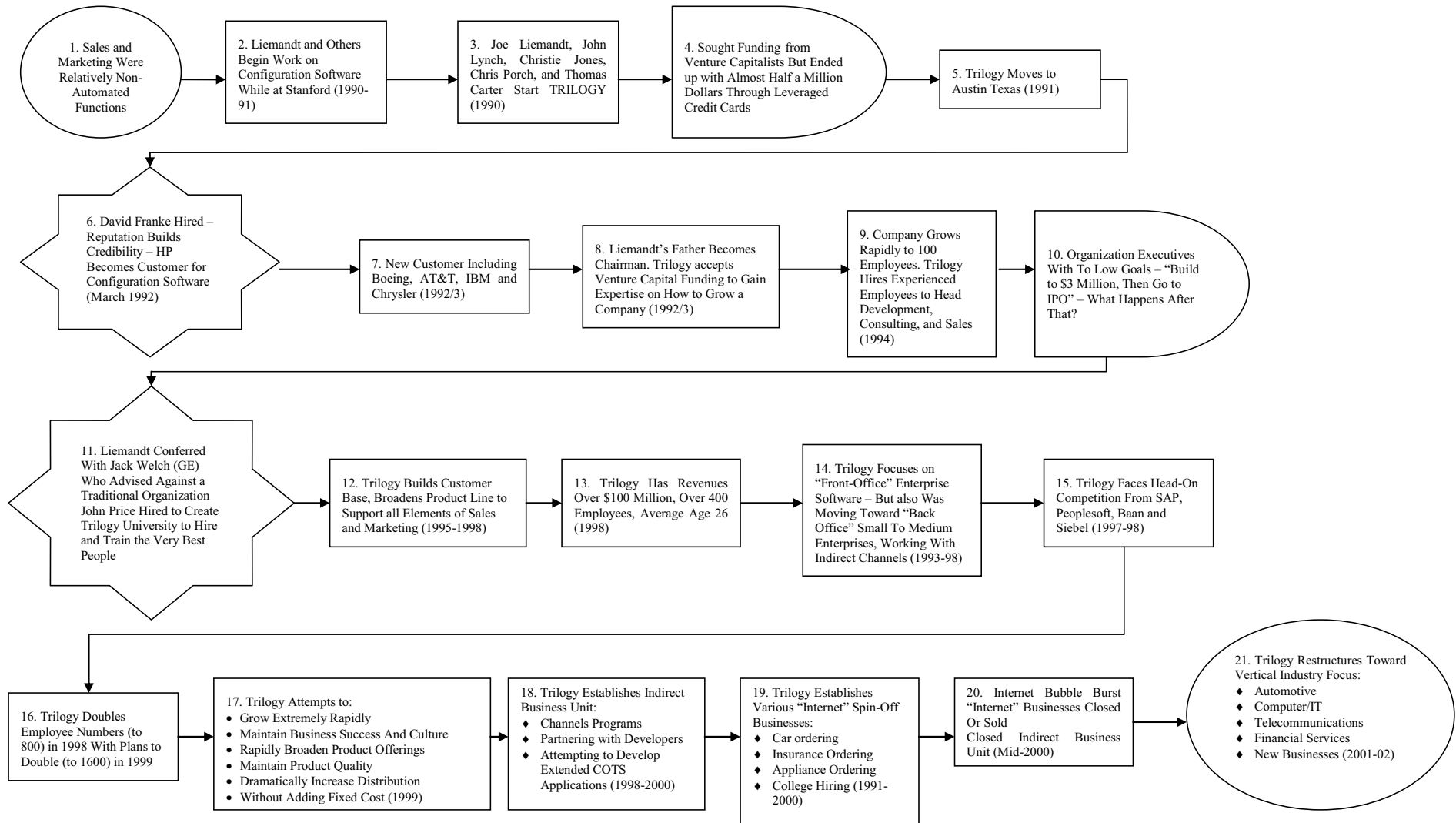
Sources: Austin (1998); Franke (2002); Hyams (2002).

Fig. 2. New summary DSA model for Trilogy application development (2001-2002)



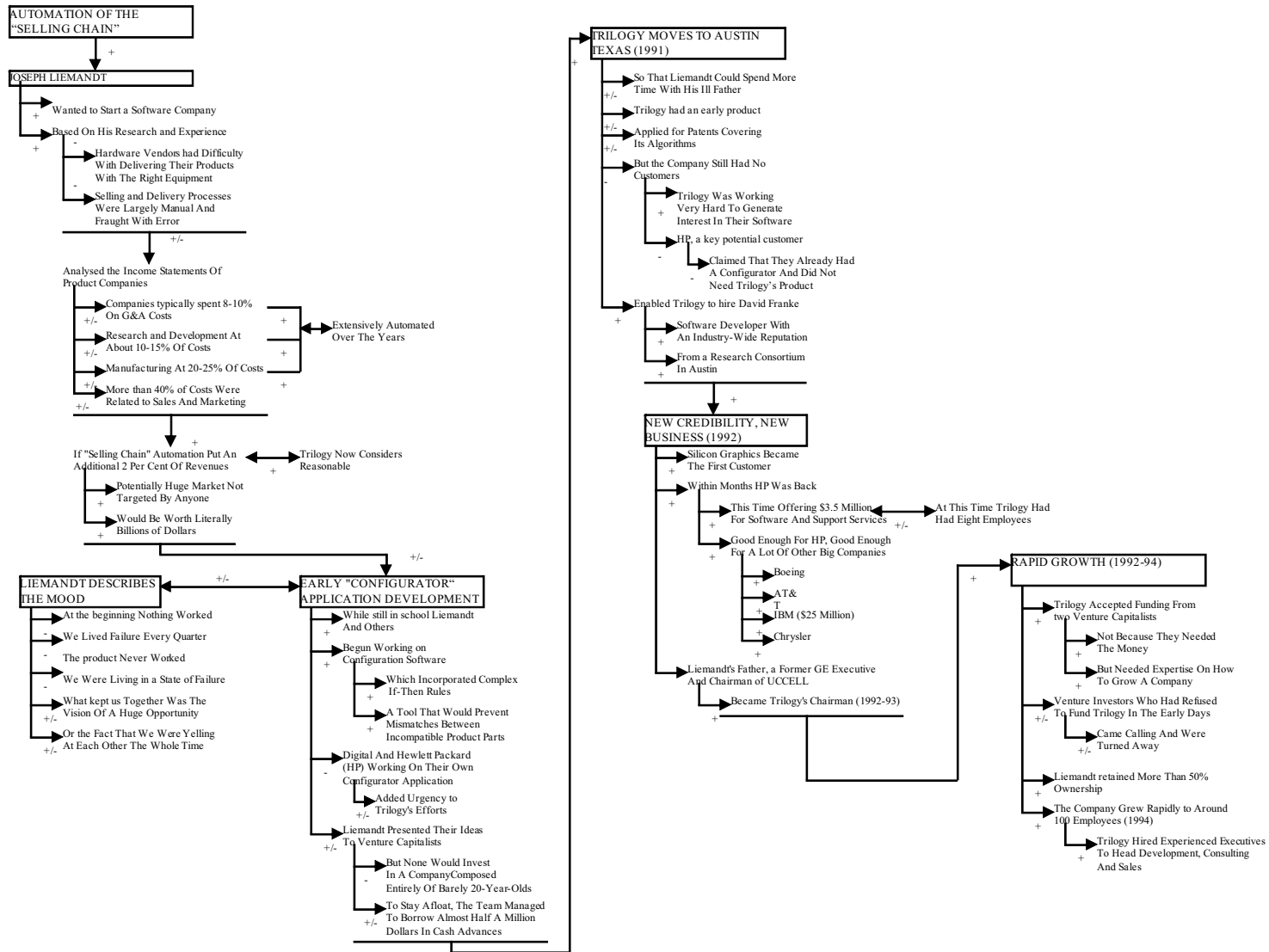
Source: Austin (1998).

Fig. 3. Events chronology map – TrilogY



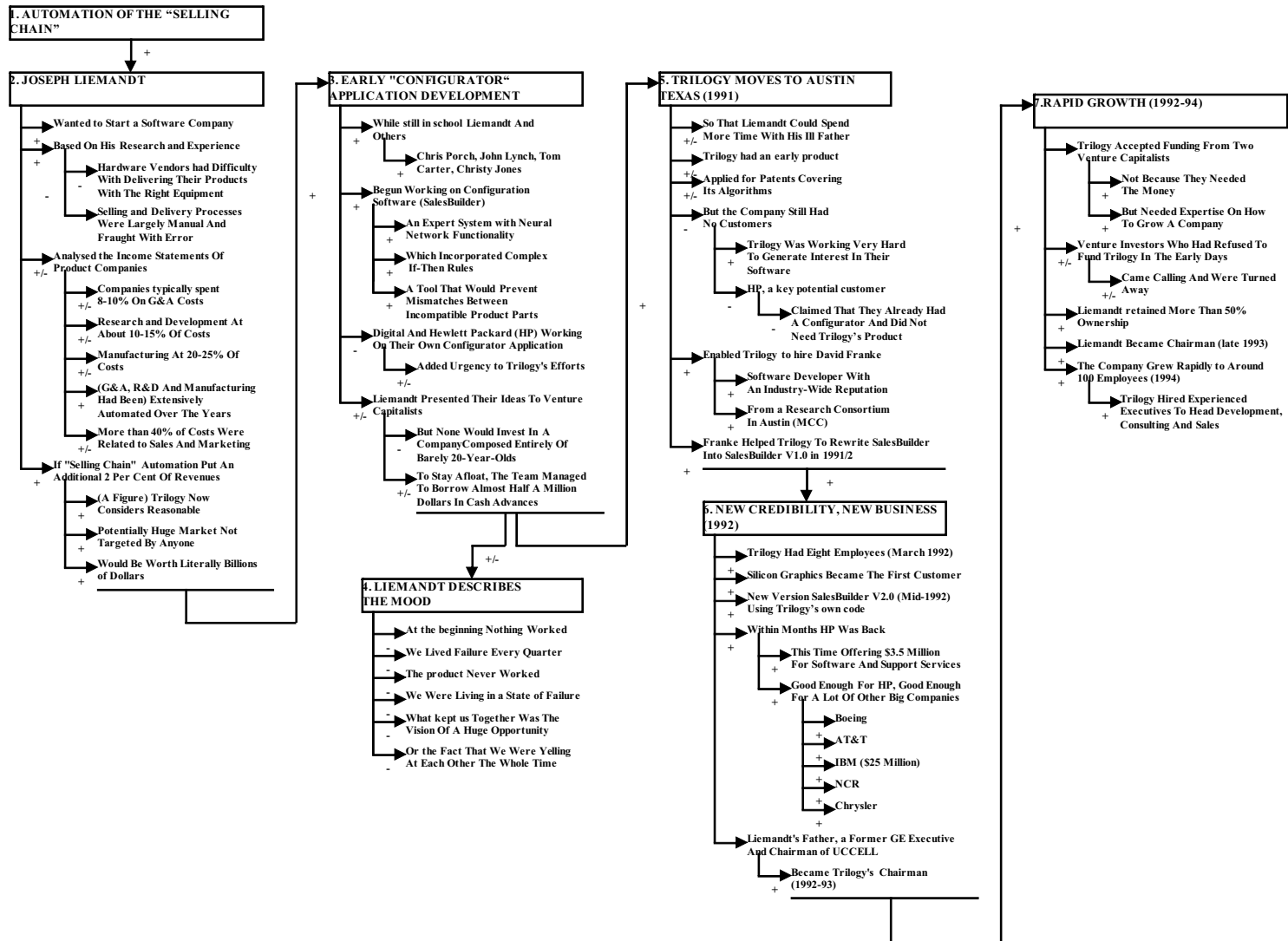
Sources: Austin (1998); Mandel & Austin (2000); Franke (2002); Hyams (2002).

Fig. 4. Updated events chronology map – Trilogy



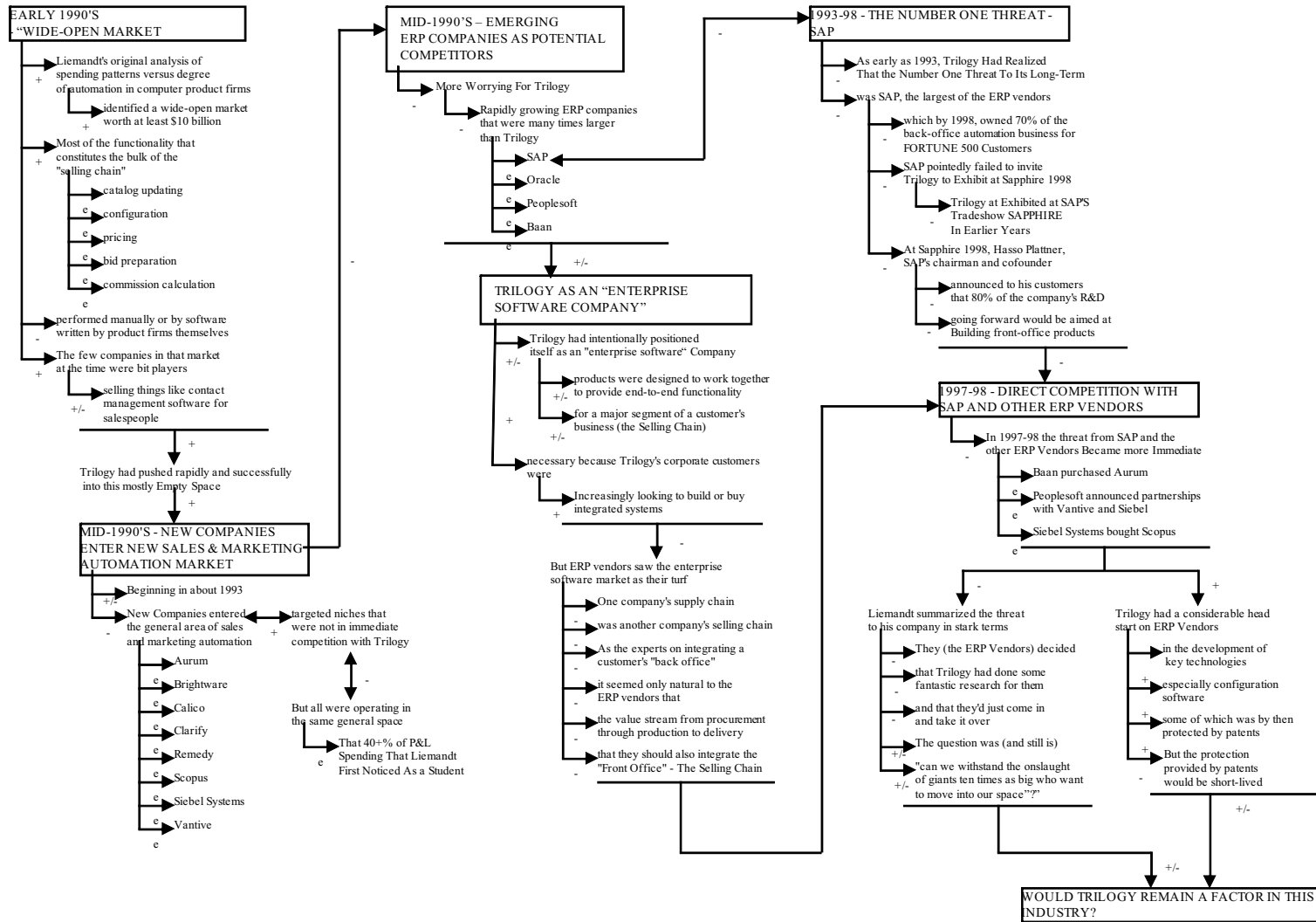
Note: This revision was shown to participants in emic 2 stage for their (Hyams & Franke) interpretation.

Fig. 5. Cognitive map – Trilogy – early development (1991-1994)



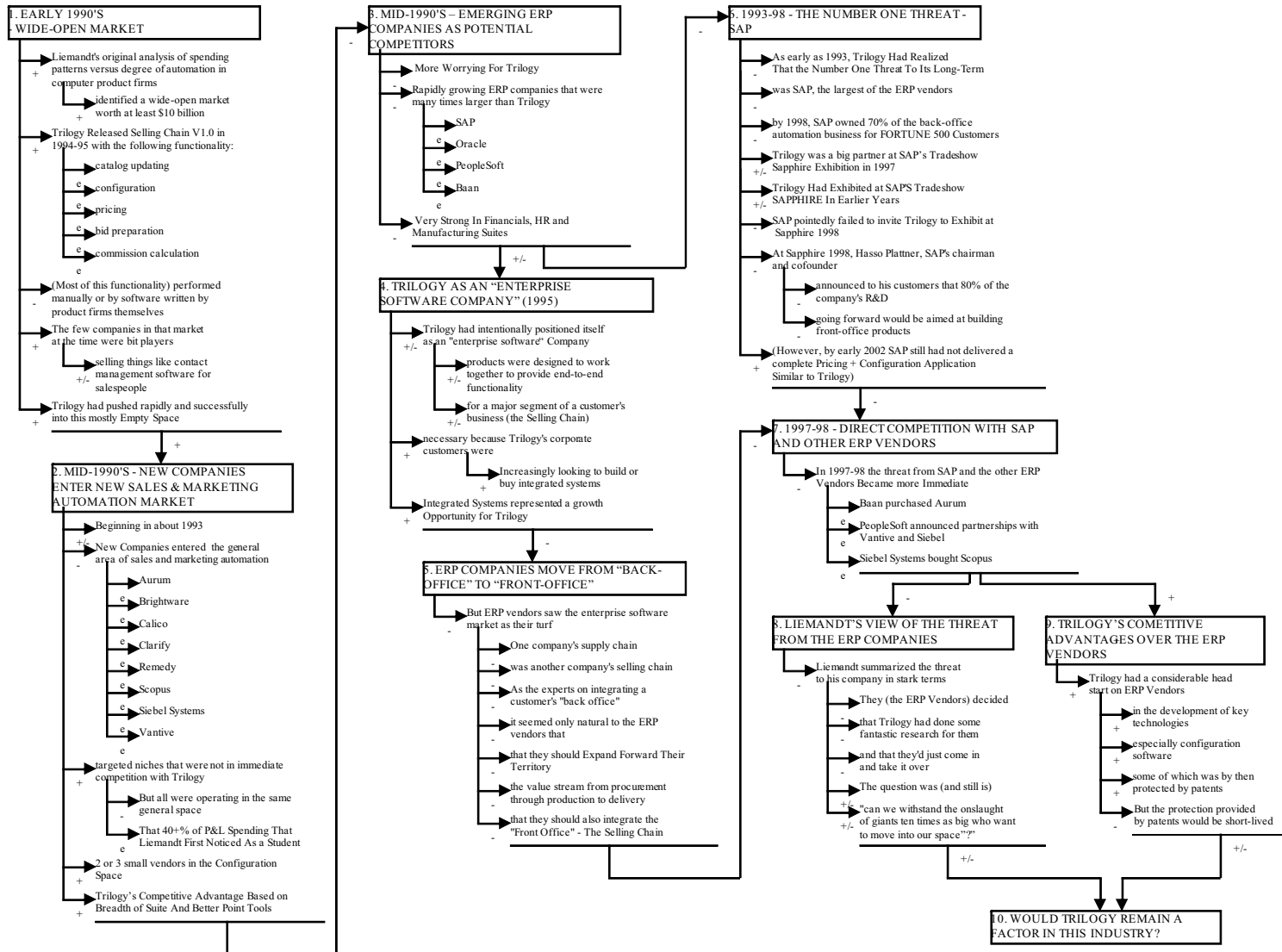
Note: This map represents etic 3 interpretation.

Fig. 6. Updated cognitive map – Trilogi – early development (1991-1994)



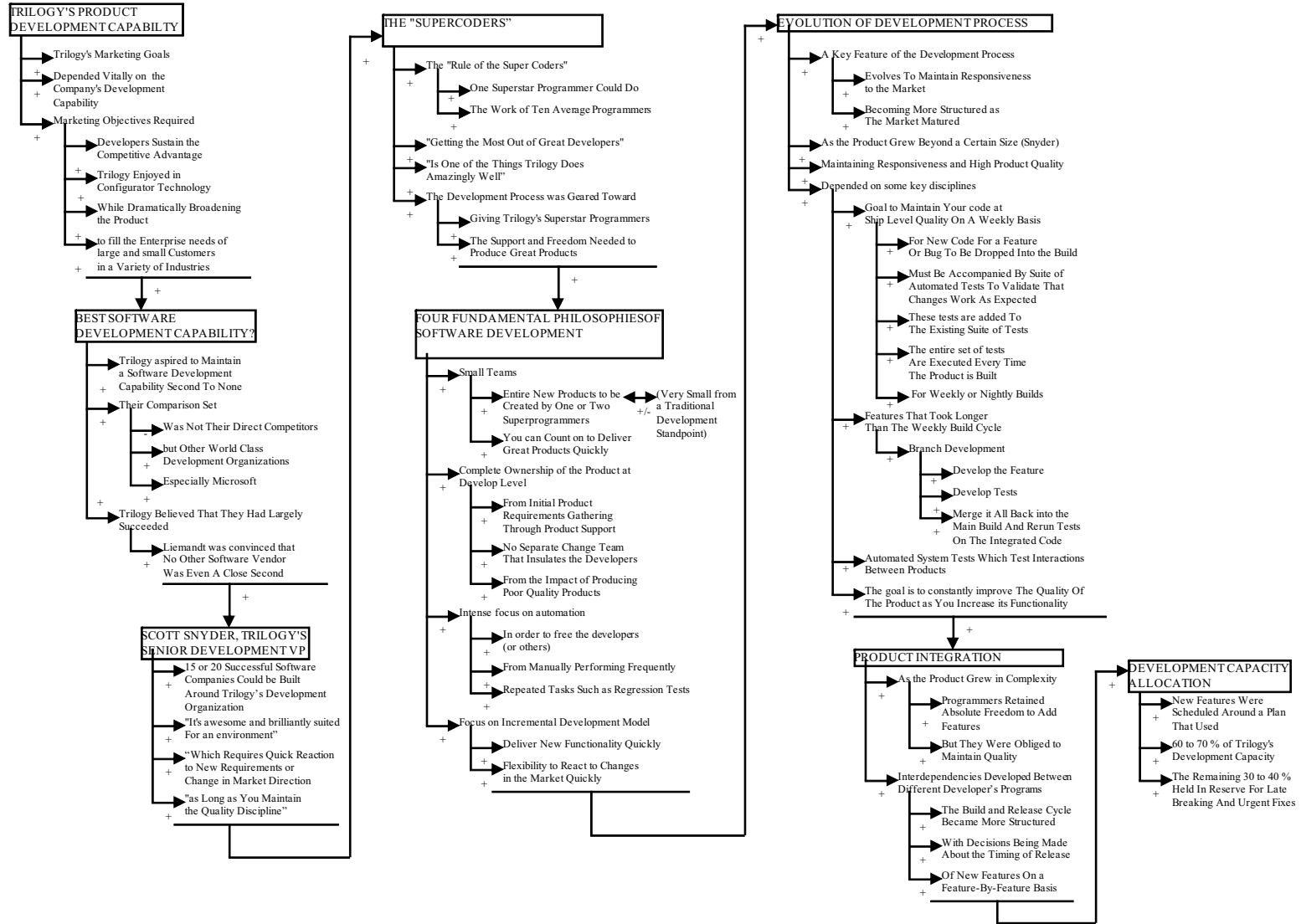
Note: This revision was shown to participants at emic 2 stage for their (Hyams & Franke) interpretation.

Fig. 7. Cognitive map – Trilogi – industry and competition



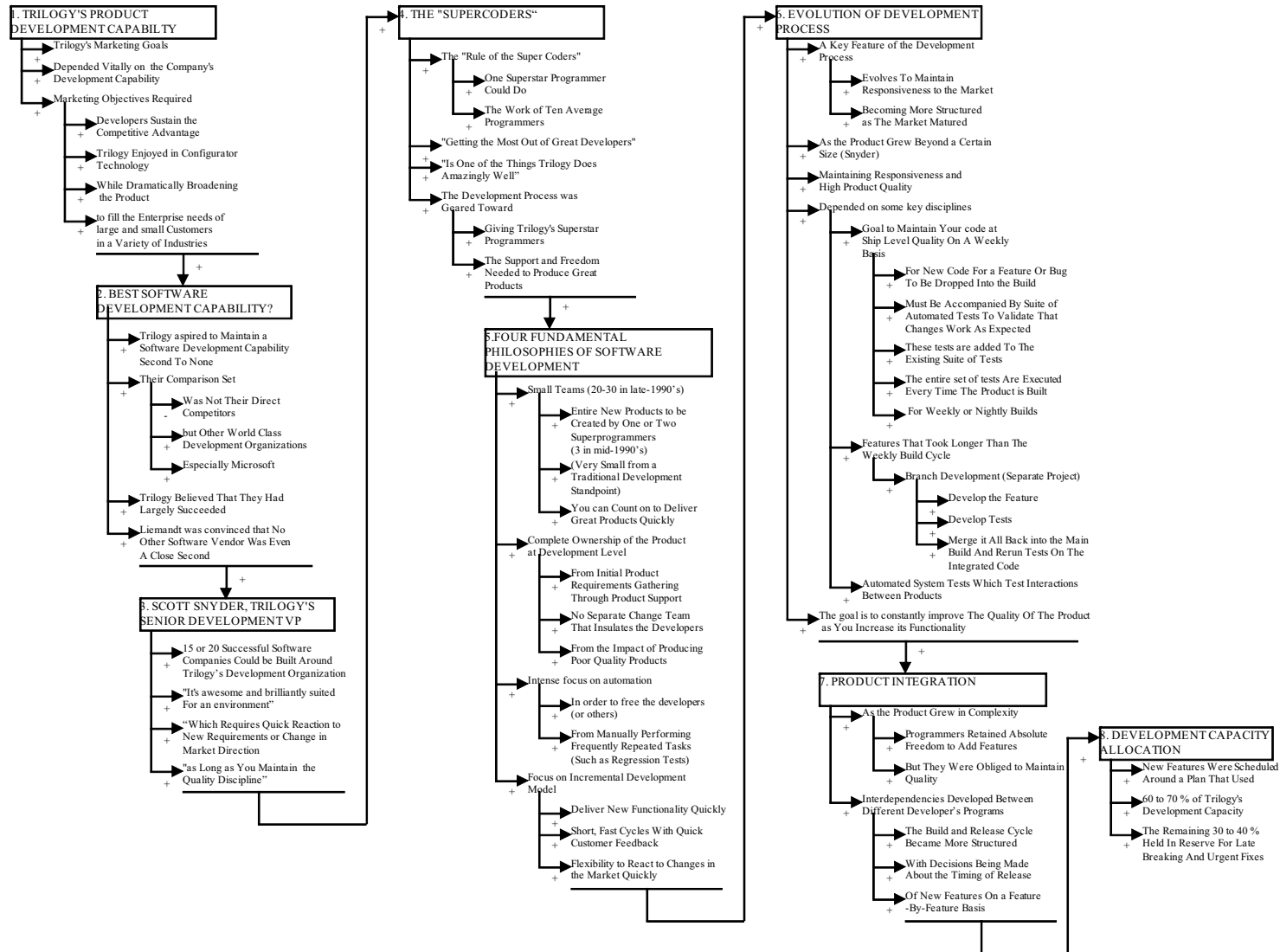
Note: This map represents etic 3 interpretation.

Fig. 8. Updated cognitive map – Trilogy – industry and competition



Note: This revision was shown to participants at emic 2 stage for their (Hyams & Franke) interpretation.

Fig. 9. Cognitive map – software development



Note: This map represents etic 3 interpretation.

Fig. 10. Updated cognitive map – Trilogi – software development



Note: This map represents the etic 3 integration.

Fig. 11. New cognitive map – Trilogi – industry-focused application development (2000-2001)