



The virtual incubator: managing human capital in the software industry

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Abstract

In a knowledge-based economy, the creation of wealth becomes synonymous with creating products and services with large software content. However, despite a few major players, the software industry as a whole is fragmented and consists mainly of small, niche market entrepreneurial ventures. The authors study the California software industry to characterize the major barriers to success for these ventures. Simultaneously, a fundamental shift of software technology to a component-based development paradigm will reinforce the industry's fragmented nature by fuelling a third party, independent software component economy. Coupled with the globalization of the IT industry in general, the need for startups and small companies to form strategic partnerships will become increasingly critical to their ability to create wealth. In recent years, innovative public–private partnerships have attempted to assist startups by addressing their lack of physical resources or capital. This is best illustrated by the dramatic growth of incubators and regional capital networks. In this paper, the authors propose a “virtual incubator” model to facilitate startup success and business network formation, shifting the focus to the “virtual value chain” and to connecting startups with business expertise and strategic partners in the marketplace. The authors provide a theoretical basis for the model and its implementation, important to potential investors in virtual incubators. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

In a knowledge-based economy, the creation of wealth becomes synonymous with creating products and services with large software content (Hagel and Armstrong, 1997). Software is that ubiquitous technology that powers everything in the Information Age, embedded in everything from automobiles to electric can openers. The knowledge encapsulated in

software will increasingly define the economic value of the intellectual capital it represents. Speaking of the importance of this new kind of capital, Stewart (1997) declares: “... [for] a new Information Age economy, whose fundamental sources of wealth are knowledge and communication rather than natural resources and physical labor.”

At the heart of this new economy lies the software industry, providing the enabling tools and infrastructure to IT professionals in virtually all other industries. A key characteristic of the software industry is that, despite a few major players, as a whole it is

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fragmented and consists mainly of small, niche market entrepreneurial ventures. The predominance of entrepreneurs and small companies in the industry will only be accelerated by the move towards a new (component-based) software development technology. Together with the globalization of business and the marketplace, both trends will fuel the need for more strategic alliances and wide-ranging partnerships. This seems to be especially true in California where software development often sets international standards, for example JAVA and HTML language variants.

These competitive drivers will have a profound effect on the US economy and in particular the management and commercialization of intellectual capital. It will present a host of human resources management challenges to both large and small companies, with the roles and responsibilities of employees undergoing profound redefinition. Indeed, the entire role of strategic partners in the value-added chain of an industry continues to undergo dramatic evolution. In this paper, we review some of the current public/private efforts to assist startups and small companies, the critical creative element in the software industry. The authors propose a virtual incubator model to enable small company success and to allow US industry to take advantage of the evolution towards distributed human resources and a business landscape dominated by international strategic partnerships.

2. Software industry evolution

2.1. Technology

The software industry is poised to undergo a dramatic evolution in the next decade, evolving from an object-oriented programming paradigm, where the software expert is still critical to the development of business applications, to the component-based software development (CBSD) paradigm.^{1,2} In a component-based software economy, software experts

will only develop relatively generic components which business or domain experts can purchase and modify to create domain-specific applications. This separation or specialization of work will allow software and business experts to focus exclusively on their own areas of expertise, much as assembly lines permitted specialization in manufacturing.

In this transition, analogous to what the machine tool industry experienced during the 19th century Industrial Revolution, this new approach to software development will lead to a replacement of hand-crafted, artisan-tailored lines of code with software “parts” or components and automated processes for their assembly. This will lead to dramatic increases in the quality, maintainability and flexibility of software while reducing its cost, development time and complexity. It will also create a new industry of third party software component foundries that can specialize around particular competitive advantages in software functionality or business domain knowledge and create independent, interoperable, top-quality components for sale.

2.2. Globalization

Globalization of the information technology business will have a critical impact on the ability to create wealth among software companies. A host of technology and market drivers coupled with government deregulation are creating a new global marketplace, particularly for software.

The explosive growth of the Internet and the Internet Service Providers (ISPs) as a low-cost, easily accessible marketing, sales and distribution channel for new software products will allow easy access to mass markets for all producers. On the other hand, large dominant firms will have the ability to create global scales of economy and global name brands and hence take greater advantage of their size and depth.

We believe that there is an interesting parallel here to other waves of technical innovation. The key characteristic that these technologies have is that they tend, over time, to increase the density of the social networks of innovators. According to theory (Wellman, 1999), this increase should increase the pace of innovation; and we feel, spread it out over

¹ Component-based Software White paper, NIST. Can be found at www.atp.nist.gov.

² Russell Dewey, “Streamlining Software Development”.

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