Offshoring and Transfer of Intellectual Property

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Abstract

Offshore outsourcing of work to support software development and services is seen primarily as a transfer of labor to another shore. But with every outsourced job intellectual property is transferred as well. Such transfers have significant long term effects on the balance of intellectual property (IP) generation and consumption. The value of intangibles is based on the income that these intangibles are expected to generate in the future. Software is part of intangible goods. The paper presents the issues of IP residing in software to the business models used for outsourcing. The use of a quantitative model for software valuation allows formal exploration of business alternatives. The motivation for this paper is to increase the awareness of the need for software valuation when developers of software and the users of that software reside in different countries. A scenario that involves Controlled Foreign Corporations as the mechanism for IP transfer is analyzed in detail.

1. Introduction

Outsourcing of work to countries with lower wage rates, or offshoring, is increasing. The common concern when discussing offshoring is on jobs flowing out of traditional high-technology countries. This view has been strengthened by a recent ACM study, prepared by its Job Migration Task Force [Vardi, Mayadas, Aspray, 2006]. While the ACM study deals well with issues of job loss and job creation, its title: "Globalization and Offshoring of Software" implies a broader coverage. However, the study ignored the value of the software and other IP that participates in offshoring. Many enterprises, involved in the creation and use of software, are similarly unaware of the value they are exporting. Even software used in an offshore call center, in an accounting business, or in a search engine, has a value to the importer when it is exploited in a new setting. In many cases, the destination for valuable IP is a Controlled Foreign Corporation (CFC), owned and controlled by the company that created the original IP. The CFC generates profit outside of the country that is the origin of the IP. If the IP is undervalued, then some excess property has flowed out of the originating country and the profit accruing from it is no longer available to pay the creators of the IP.

When the ACM study was released, it was widely picked up and quoted, as for instance in the lead sentence in a New York Times article: "A recent ACM study has found that the fears of offshore outsourcing undermining the United States' competitive advantage in computer science and technology have been overstated" [Lohr, 2006]. However,

generation of income requires both people and capital. Our professional associations are, of course, more concerned with the immediate worries of their members, and may try to assuage them. When the effect of offshoring is analyzed, we deduce that over time the effect of providing IP, originally created by the offshoring sponsor over many years, to the host companies, especially CFCs, may exceed greatly the effect of the job transfers [Economist, 2007].

Outsourcing of work to support software development and services to other countries requires transfer of supporting resources. Those resources have value, and represents intellectual capital. While Marx was concerned about labor and tangible capital goods as the drivers of the economy, in today's knowledge-driven environment it is the intellectual capital that counts. A significant part of that intellectual capital is software, and is property (IP) of the outsourcer. This paper discusses the relevance of valuing software when offshoring. An actual valuation method specific for software has been presented by one of the authors [Wiederhold, 2006]. The analyses that led to the development of a consistent software valuation method were motivated and supported by the need to assess software IP exports, especially in the case of CFCs.

Little specific guidance existed for software valuation. Computer scientists have worried about development costs, and ignored quantifying the benefits of having software [Boehm, 1981]. It was left to lawyers, economists, software vendors, or promoters to quantify the benefits of software in commerce. The results were mostly inconsistent [Lev, 2001]. To assign a value to software required bringing together information from domains that rarely interact directly: software engineering, economics, business practice, and government regulations. Having a valuation method allows estimation of the significance of software transmitted as part of outsourcing. This assessment can be combined with a quantification of the effect of the complementary labor transfer. More than software alone is involved in IP transfer, but this paper will focus on that portion. When software is exported or imported during outsourcing, assigning an appropriate value is crucial. Software that is broadly used has values ranging to hundreds of millions of dollars, and companies can thrive or collapse based on gains or losses of the IP the software represents when outsourcing [Scholte, 1997].

1.1 Outline

The next section defines when software and related information are considered IP appropriate for valuation. Section 3 lists the business models that are used in offshoring, with an emphasis on issues that should require valuation of transferred IP. Section 4 provides a brief introduction to the principles of IP valuation, both for the creator and the user. Section 5 describes what happens to transferred IP inherent in software over time, a crucial issue in valuation. It shows that reasonable valuations for many types of offshore IP transfers can be produced. Section 6 describes the business models in terms of the valuation and its effects on choosing a transfer method. Two models, outsourced software maintenance and outsourced web services, are described in more detail. Section 7 sketches tax consequence for various offshore settings. The conclusion in Section 8 summarizes the use of software valuation when offshoring is planned or re-evaluated.

2. Outsourcing and Software

In this section, we cover the relevant fundamentals for valuation of outsourced software. We first establish when the value is an issue and subsequently the range of software and related IP that can be part of outsourcing activities.

2.1 When is Software Property?

The term property itself can create acrimony when it is applied to knowledge and its manifestations. Many leaders in the computer science community argue that intellectual property embodied in software should be freely available [Gay, 2002]. Indeed, early software was essentially free when it was seen only as a means to sell costly computer hardware. More than 50 years ago, organizations such as SHARE [Glass, 1997] were founded to encourage sharing of software without any reimbursement. Most early software was contributed to the public. Today some of the world's most successful software is free (GNU/Linux). Free software, while having a high intellectual merit, is not considered property.

Open and free software is an attractive goal, but the scope of free software is limited by the interests and resources of its supporters. Given the pervasive use and costs of computing, not all software needed by industry can be delivered freely by experts motivated by enthusiasm, academic recognition, or philanthropy. Providing software freely in oder to support hardware sales is difficult now that much hardware is a commodity item, and the cost of computing is predominantly due to software. In 2002, U.S. software industry (SIC code 7372) sales exceeded $32 billion [Compustat, 2004]. This amount does not include software incorporated in tangible products or software expenses within enterprises. Businesses in the U.S. spend about 10% of their operating costs on information technology, and it is estimated that 80% of that expenditure is now due to software. Excluding service industries, those ratios give us an estimate of over $250 billion for annual commercial software costs. Billions make little sense to most of us, but, for comparison, the total U.S. federal expenditures for education, that year, were just over $56 billion. It is unlikely that all software will be free in some future scenario.

Software, when not a free, public good is owned in some way, and hence is property. Property that is of value to the owner must be protected from loss. The protection of software and media content has been a topic of much ongoing debate, not showing much resolution since early days [Branscomb,1991]. Since software and related material are easily copied, it is the content that warrants protection, and not its tangible representation: the paper, the disks, or the file storage within computers. The ratio of the tangible media cost to the total value has diminished to practically zero. Distributing of content over the web incurs no cost for tangibles. This paper, hence, focuses on the content, i.e., the intangible part of the property.

2.2 Types of Intellectual Property

Confidential knowledge in an outsourced setting that enables an outsourcing host to perform work for the sponsor includes:

- Design specifications
- User guides
- Proprietary software for use in the host operation
- Software that is the basis for further development at the host

- Process descriptions for further development
- Instructions transmitted under confidence that provide an understanding not obvious from primary material

and, if the host also resells the products in the foreign geographical area,

- Rights to use established trademarks
- Literature that describes the products for the customers
- Business methods that make sales effective
- Instructions on exploiting the business methods

When this knowledge is not specifically documented, it is hard to distinguish what is common knowledge, and what is truly proprietary within the business interaction.

The means available for protection on intangible property are copyright, trademarks, patents, and trade secrets. When software is sold to the public, copyright provides the major means for protection. Enforcing copyrights, especially outside of the country of origin, remains hard [Johns, 2002]. To simplify enforcement, much software is licensed, rather than sold, so that it remains legally the property of the creator or their assignees. Issuing new, updated versions of software obsoletes prior versions, and lessens the value of unauthorized copies. Trademarks are more effectively defended, since their misuse is visible. Even names of websites enjoy some protection now [ICANN, 2002]. Patents imply novelty, but much important software in use is not visibly novel, and hence is not effectively protected by patents [Stobbs, 2000]. Defending patents, or defending oneself against unwarranted patents, is costly and frustrating, so that patents play a very small role in protecting intellectual property. For the specific issue in this paper, outsourcing, no broad publication is required. The collaborating partners share knowledge. That knowledge will be kept as trade secrets, even if it also involves copyrighted documents and patents. The evidence for broad trade secret protection is that employees and consultants of the partners are required to sign non-disclosure agreements (NDAs), promising to keep all the knowledge acquired from partners confidential.

3. The Outsourcing Business

To simplify the discussion in this section, we will use a setting where a sponsor company -- the provider of the IP -- outsources work to a host company. To perform the work, the host company requires access to the intellectual property (IP) of the sponsor and becomes a consumer of the IP. In general, sharing of IP occurs in both directions, and we will return to that generalization later.

We consider two approaches of hosting the work:

1. Outsourcing to an independent host. If that contractor is located offshore, the host is considered an Independent Foreign Company (IFC); and
2. Outsourcing to an owned or subsidiary host. If that company is offshore, the host is a Controlled Foreign Corporation (CFC).

The distinction is important from the viewpoint of protection of intellectual property.

3.1 Contracting

There are many IFCs, companies that host services for outsourcing. Most pride themselves on the secure manner with which they protect the owners' intellectual property. Still, the providers of IP have some reasons to be worried. The employees of

an IFC are likely to work on more than one contract. Also, the loyalty of employees of an IFC will be primarily to their employer, rather than to the owners of the intellectual property. Even when design specifications are protected, it may be difficult to protect the underlying concepts. Neither can development methods be strictly sequestered in an IFC host setting, though a number of vendors claim that they are developing new approaches to achieve this.

For software the boundaries of intellectual property are hard to discern. For instance, when software is being developed, it is impossible for a programmer to be aware if a method provided was unique, was learned in school, or is actually an approach in the public domain, but not identified as such.

Sharing of software concepts can lead to improvements that benefit all, including the owner, unless the intellectual property has a higher value if sequestered. The next section of this paper will deal with such valuations. The ability to assign value to intangibles helps in making the business decision to use the services of an IFC host, since now the likely IP risks can be offset versus the associated prices and benefits.

3.2 Captive operations

Whenever the value of the intellectual property is deemed to be high, the preferred approach is to set up a captive entity to provide the service, a Controlled Foreign Corporation (CFC). The control provided by ownership should reduce risk of IP loss, even when operating under different laws and standards, although it increases the management overhead. The employees of a well-managed CFC see themselves as being part of the owner's organization, and will protect the owner's intellectual property if good incentives are provided. A CFC must keep its own books, and will transfer costs or profits to its owner as required.

A CFC is likely to also function as marketing and sales arm in its local geographic and language area. Having a capable local entity provides important added value when products have to be adapted to other conventions, when documents have to be translated, and when marketing techniques have to be adjusted. For such services, more IP may have to be transferred, as listed in Section 2.2. For efforts related to sales, the allocation of IP consumption to the CFC can simply be based on the relative sales fraction. For instance, if the CFC sells 25% of the owner's products, then the value of the shared IP is 25% at the CFC of the total IP value of the umbrella organization.

3.3 Why must IP be valued?

If tangible goods, say machine tools, are being transferred to a CFC, their public price is generally established, so that the providers have a good idea of the value being exported. That knowledge is lacking in internal-use software, so that software and related IP necessary for a successful offshoring project are often transferred without properly valuing that property, even though the risks of losing that property may well be discussed.

The valuation of IP, especially for software, is hard. Software, once written, is easy to replicate at a negligible cost; each subsequent instance is sold for much more than its incremental cost of production. Surprisingly, the value of IP is independent of the cost and effort spent to create it. A few brilliant lines of code can have a very high value, whereas a million lines of code that generate a report that nobody reads have little value.

The value of IP is determined when it is consumed, i.e., used to generate income [Smith & Parr, 2000].

The entire value of a software company depends on those products. A first-order estimate of the value is the company's market capitalization – the number of shares times the value of each share, as determined by its investors. The effects of risks of IP loss can only be quantified if the IP has been valued. For a software company, losing a significant fraction could be devastating. But other business categories, as manufacturers and financial institutions, also depend substantially on software to enable generation of revenues. Any business that distinguishes itself from others by IP embedded in software is equally at risk. If sponsors of an offshored operation know the value of the IP they have to export to enable the venture, they will be better prepared to make decisions about offshoring. They will also be able to better report to their directors and stockholders the costs, benefits, and risks of their actions.

3.4 Outsourcing Operations that involve Software

Common applications for the information technology involving software exports include:

A. Call Centers, where the host provides assistance to customers having problems with a sponsor's product, using software tools provided by the sponsor.
B. Offshored operations, where software from the sponsor supports a manufacturing, financial, supply-chain, or other service process.
C. Web services, where products are made available to process customer data.
D. Software localization is a natural extension, exploiting local capabilities.
E. Subtasks of software development and production.
F. Shared development, as defined in the 24-hour software factory
G. Software creation, where new products are developed.
H. Software Maintenance, where existing software products are repaired, adapted, or extended.
I. Regional marketing and sales.

In Section 6.2 we revisit these alternatives, applying some of the findings reported in this paper. The general model described here can be applied to any such application even though the parameters, the dependencies, and the risks among the partners differ.

3.5 Risks

Existing software is easy to copy, and at risk even if limited to internal use. But software also looses its value rapidly. Software must be maintained to keep up with changes expected by users and the setting where the software is being used. While a book written and printed two years ago can be profitably sold for, say 80% of its new price, a prior version of software has little value for a user. Version life is hence an important aspect of software valuation in outsourcing. Software life is also important for valuation within a company, and must include successive versions, since a new version of the software product includes much of the code and all of the functionality of its prior versions. A previous paper covers software life for valuation only for the owners of the software [Wiederhold, 2006]. When risk assessment has to be done, the appropriate metrics must be used, based on the type of risk being considered. This paper does not deal with the risk models themselves.

3.6 Location of IP in the CFC case

In Subsections 3.1 and 3.2 we distinguished offshoring to a wholly independent (IFC) versus a fully owned entity, a CFC. A CFC operates as a complete business, with its own records of costs and revenues. Three alternatives for keeping the IP are now possible, as shown in Figure 1.

In the first alternative the formal ownership of the IP remains at the origin, and payment for their use is in the form of royalties. The royalties should fairly reflect the contribution to income for the use of the IP at the CFC. That income determines the value of the software and other IP being in offshoring. Such an arrangement typically requires valuation of all the IP used, including the software. Such software will be maintained at the origin, and the valuation model should include that ongoing effort. If the royalties are set too low, the CFC will show a higher profit than it should, and the owner of the IP will show less profit. If the royalties are set too high, the CFC will show a lower profit than it should, and the income shown at the origin will be excessive. While the net revenue total for the consolidated accounts will not be affected directly, differences in tax rates can affect the total profit of the company.

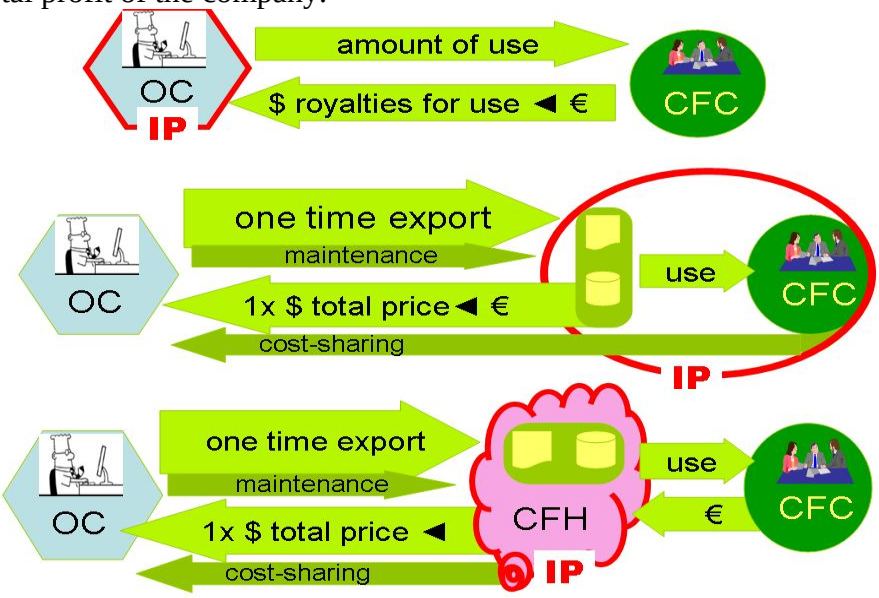

Figure 1. Three alternatives for IP locations.

The second alternative for the CFC is to invest in importing the software. In general, investments are needed to create a profitable entity, and purchasing IP, a so-called Buy-in, is a common strategy. A one-time investment charge will appear in the books of the CFC, and the originating company will show a sale to the CFC equal to the Buy-in amount. Over the long-term, if the CFC is located in a country that levies low taxes, another benefit accrues, because the profits of foreign operations are now taxed at a lower rate than the rates in the home country. The books of the originating company (OC) will show a sale, which may well be significant fraction of the worth of the company, and will be taxed on it.

While tangible property, such as manufacturing equipment, has to be located where it is being used, intangible property can be located at places far from its use, and can collect royalty there. This ability to export intangibles to arbitrary locales has created the use of a third alternative, a Controlled Foreign Holding (CFH) company, located in a country with low or no taxation. Now the countries using the IP, as a CFC, must pay royalties to the

interposed CFH. If the royalty rates to be paid the CFH are set high, the profitability of the CFC is reduced. The consolidated accounts will benefit from the low net income on work performed at the CFC and the negligible taxes levied on the revenues transferred to the CFH.

When IP is paid for in a royalty scheme, maintenance costs are included, and product improvements are made available at no extra charge. Maintenance corrects errors, adapts software to changing external conditions, and perfects its internal operation and user interfaces [Marciniak, 1994]. If a CFC or CFH has imported a version of the software, it must pay for any needed maintenance as a distinct activity, referred to as cost-sharing [Levey, Wrappe & Chung, 2006]. Cost-sharing payments do confer ownership rights, so that the proportion of the IP held in a CFC or CFH will increase over time.

In Section 7, we will revisit tax consequences associated with these alternative locations. In all alternatives, fair treatment of the participants requires trustworthy valuation of the transferred IP.

4. Principles of IP Valuation

The assignment of value to intangible property is assuming greater importance as our society moves from dependence on hard, tangible goods to a world where knowledge and talent create intangible goods that everyone needs and desires. Many approaches for IP valuation compete [Damodaran, 2002]. We assume now that ownership by the sponsor has been established.

The simplest way to value something is to determine what an identical item costs under the same condition. But the value of IP is due to its uniqueness, so that true comparability is rare.

4.1 General

The principle of valuing IP is to determine the future income associated with its ownership [Smith &Parr, 2000]. Note that by that rule the value of IP is independent of its cost. The creation of a musical composition, invention, or software may cost little, and can generate a very high income. The determination of future income requires estimating the income due to the IP in each of all future years over its life; i.e., the amount sold and the net income per unit after routine sales costs are deducted. If the IP is used internally, for operational benefit, then the savings accrued by owning the IP can be similarly estimated.

The intangibles of a company in the knowledge-based domain includes the technical knowledge of its staff, the competence and insights of its sales force, the business knowledge of its management, the worth of its trademark, its reputation, and the value of its software inventory. Not all of those components are property and the means employed for transfer to a host for outsourcing will differ.

The reputation of a company and the value of its software are two core components in valuing intellectual property (IP) of a software-based business.

4.2 Bookkeeping

One major problem with assessing a company's intangible property is that U.S. General Accepted Accounting Principles (GAAP) do not allow the listing of IP on corporate books. The effect is that the book value shown is a fraction of its realistic value. The lack

of information on what is the major contributor to income of software and similar companies makes it hard for investors to be rational about purchase prices. However, shareholders of public companies in the aggregate do estimate the future income they expect to receive through the price they are willing to pay for shares. The market capitalization, the price per share times the number of shares outstanding, is then a measure of the company. Subtracting the book value, is a measure of the intellectual capital of the company. A method to assign a fair proportion of that intellectual capital fairly to their staff and to the IP owned by the company is presented in Section 4.5. metric.

We do see on the corporate books the investments in Research and Development and, less clearly, expenses incurred for marketing. Those two types of expenses, classified as Intellectual Property Generating Expense (IGE), are rarely capitalized, since they only generate intangible value, not seen on the books. Only when a company has been purchased will the purchased IP briefly appear on the books as a vague concept called goodwill.

Once the intangible goods have been created, they are replicated for sale at negligible manufacturing cost. The Net Income, namely Revenue minus the Cost-of-Goods-Sold (CoGS), is then nearly the same as the Revenue. A traditional measure of assessing a company, the profit margin, computed as the ratio of Net Income/revenue, now becomes nearly one. Indeed, software companies often over show profit margins over 90%. Other common metrics fail similarly and disable accepted investment approaches for comparing companies.

The reason for these irrational ratios is that knowledge acquisition, information systems development, and software maintenance are all classified as research activities (R&D); they are deemed to be "investment that generates new IP". The current accounting practice lumps development and maintenance costs together [Lev, 2001]. Actually, the software maintenance needed to remain viable in these businesses consumes a large portion of the total effort classified as R&D [Boehm, 1981]. Experience shows that fraction to be typically between 60 to 80%, as summarized in [Wiederhold, 2006]. It would be wise if required software maintenance, whether it is performed at the source or offshored, were to be accounted as CoGS expenses. Then the reportable profit margins would likely be within a range of 20% to 50%, allowing a fair comparison with other businesses and the cost of capital needed to create and maintain such businesses.

4.3 Life of IP

Just as any other property used to generate income, intellectual property becomes obsolete over time. But the maintenance refreshes the long-term value of the software, while reducing the income available for other tasks and for taking profits. Failure to maintain software drastically reduces its value, since as soon as customers realize that the supplier no longer fulfills expected obligations new sales will stop and existing customers will look for alternatives. Maintenance costs tend to increase over time, as the product gets larger and more complex. When income attributable to software becomes less than the cost of its maintenance, then its effective life, and its contribution to IP value ends [Spolsky, 2004]. Since some original concepts embodied in software can live forever, in our analyses we typically limit IP life to the time when less than 10% contributes to income, as indicated in Figure 2.

The projection of future income requires discounting to its value in the present. Without risk, the future income is discounted to the current time by using a stable discount rate; in the U.S., this is done by using the Federal Treasury Note rate for the future periods. Additional risks specific for intellectual property include replacement by better technology, unauthorized copying, patent breaches or invalidation, and loss of trade secrets. With such risks, discount rates increase, based on the expected Beta coefficient [Barra, 1998]. With high discount rates, sales that occur far in the future have little effect, simplifying the determination of the net current value of the IP available for outsourcing.

To assess the current value of software that is being maintained the annual future maintenance expenses over the life of the software should be subtracted from the annual expected income before discounting to obtain the net present value. But since the income from maintained software will be greater, often much greater, the net present value will be greater as well versus software that is not maintained and has a short life.

4.4 The value of software IP for software producers

Since the value of IP cannot be assessed by its development cost, it has to be valued by its contribution to the income of a business. From the viewpoint of software seller, the income generated from the software depends on the sales revenue, i.e., the product of software sales and its unit price. In the earlier paper, the value of the IP inherent in software was estimated by considering its unit price, its useful life, and the expected sales with its diminishing contribution over its life [Wiederhold, 2006]. While many assumptions are required, there are useful guidelines and rules that can support valuations. When the outsourced software has been in use prior to its transfer to a foreign shore, information for estimating the required parameters is available.

In an outsourced setting, some of the ongoing costs will be incurred at the sponsor site and some at the CFC. The cost should be shared proportionally to the benefits to be obtained from the IP. To compute the required cost-sharing payments for alternatives 2 and 3 of Figure 1, the research and development costs from all locations are first aggregated and then allocated according to revenues in the home and CFC geographical areas. Any costs that exceed the revenue apportionment are then reimbursed from the other side. While, in principle, this arrangement is simple, it becomes complex when IP has been contributed by multiple efforts, since IP is also generated by brand and product marketing, which will have different lives than the technological components. Since no amount of marketing can overcome poor product quality, we concentrate on the portion related to software.

4.5 The value of software IP for internal software

Many businesses depend on software that is internally developed or built to order. Again, since the value of IP cannot be assessed by its development cost, one has to focus on income. But only a fraction of the company's income can be attributed to the software, when services are provided there are additional investments, primarily in creative people and machinery. An allocation has to be made. Income due to software can be assigned based on the assumption that the management of a company is rational in the allocation of its resources, a standard textbook assumption [Samuelson, 1983]. Assuming optimality, corporate net income created by diverse expenses can be allocated according to the proportion of costs incurred.

For most businesses in the knowledge-based industries, as finance, equipment costs are minor. Then the allocation simply partitions the companies intellectual capital, people that contribute value and IP. If a company spends more than is optimal on software and relatively less on people or equipment, its potential income is reduced. If it spends too little on software, the overall income will be reduced as well. The fraction spent on software from year to year will vary, but over time such variations even out. If a company behaves irrationally in its spending, it is bound to have lower net profits, and both its IP and its prospects will suffer as a result.

5. Diminution of Software Value

Once the software has been imported by the CFC or CFH, the value of the initial investment will diminish. Bookkeepers consider depreciation of assets, but that model does not match what actually happens with software. Ongoing maintenance keeps the software effective and able to generate income, but maintenance expenses also require an ongoing cost-sharing reimbursement by the importer.

5.1 Estimating the diminution

Since the software IP was embedded in the original offshored code, and that body of code changes over time we assessed the typical code contributions due to maintenance [Wiederhold, 2006]. For assessments of existing code, the actual code can be analyzed. The fraction of original code remaining is taken a surrogate for its relative value, as shown in Figure 2. This figure, and others in this article illustrates the general trend. Actual analytic results, using actual data on effort, show irregularities due inconsistent management decisions and version release timings, but still display this trend.

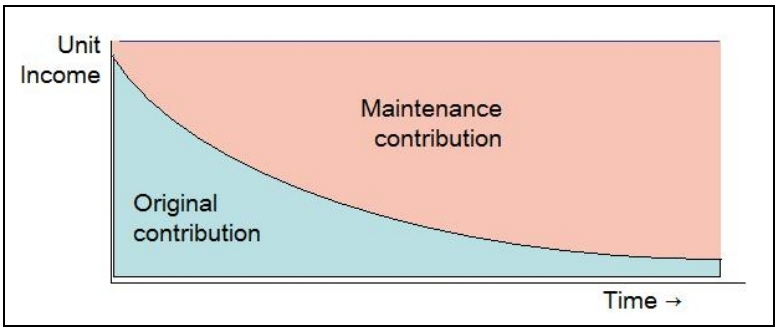

Figure 2: Diminution of the value of the original IP contribution in software

Even though the total code grows steadily, the unit price for software products tends to be stable. Customer expectations and competitive threats make it hard to raise software prices for the same functionality, even if the software is now characterized by fewer problems, increased capacities, and a smoother interface. Combining the relative growth and constant price allows an assessment of the value remaining of the original investment and the delineation of appropriate royalty rates.

A typical life span for a successful software product is about 15 years. Over that life, there may be 10 significant version releases. Early in its life, there maybe several versions in a year and later in life, several years may elapse before a new version is warranted. Software that has significant dependencies to external conditions will require more frequent update, and hence a higher level of royalties or cost-sharing. For instance, software that supports logistics requires updating whenever capabilities of carriers change.

5.2 Measuring Software

In our model we measure IP contributions simply by lines-of-code (LoC) the output of software development and maintenance [Wiederhold, 2006]. While LoC is certainly not a perfect metric, much literature and documentation exists, including mapping functions for most languages [Jones, 1998]. An alternative is to measure the input, the R&D expended over the prior periods for development and ongoing maintenance tasks, together with the lag before those investments show results. However, the process of classifying, allocating, and aggregating all the efforts to specific products and product improvements is well-nigh impossible in practice.

A simple metric, such as as LoC, is easy to criticize when assessing the relative contribution of old and new code. The original code provided the value for the initial customers, made the product viable, and positioned the current product in the market. Concepts embedded in old code become well understood, and could be replicated by competitors. New code fixes errors, scales the programs, and adds new value. Keeping code fresh keeps competitors at bay. In the end, the arguments of old versus new code balance out, and since no better metric is available, it is the choice taken in the quantitative model. The results have been validated.

Note that there is no attempt to actually value the software by the LoC quantity. Only the relative size matters to establish the diminution, so that contributions to be allocated to the IP value can be allocated as part of the software at any future point.

5.3 Importing Mature Software

The curve in Figure 2 shows the diminution of value from the point of initial creation. If the export pertains to software that has reached a more mature point, the curve from that point on will be less steep, and the relative diminution with each new version will be less. But the remaining life will also be less. Such a situation is actually typical, since during initial development software creators will have given little thought to outsourcing possibilities. Only when their software is successful, and call center and maintenance demands grow, is outsourcing considered.

At that time, the business risk is less. Especially if the software has already been successfully used outside of the country of origin, the risk normally associated with a new venture is reduced. That will be reflected in the cost of funds needed for the import. The funding of mature software still has risks, and discount rates as high as 15% are appropriate for such an investment. That cost has to be included in the business models. Again, without having valuations of the IP needed at the CFC, a business model which only considers labor costs will be incomplete.

Hence, the estimation of the IP value of software requires estimates of the current sale price, future version frequencies, maintenance cost expectations, and sales volumes over its life. A spreadsheet is available with one of the authors [Wiederhold, 2006] to assess the values of possible business alternatives.

5.4 Complementary IP

IP is not only generated by software investments, but also by marketing investments. The distribution of investments for a CFC may differ from the allocation of the overall expenses of the company. As a first-order estimate, we find that companies spend similar amounts on research and development as on marketing. If a company or product is already well known internationally, the receiving CFC may have to spend less. In that

case, the CFC profits from trademarks and brand names that have been previously established. These also represent IP and should be considered for purposes of reimbursement.

Advertising expenses are typically taken as current expenses, even though they increase the IP value of the company. However, the effects of advertising tend to be short-lived, and have less importance than word-of-month recommendations for quality software.

The allocation and reimbursement policies for such market-related IP are beyond the scope of this paper; these policies convolute the valuation of software exports and imports.

5.5 Allocation among the IP creators and consumers

It is effective for the CFC to market and sell the products in its local region. Especially when software interfaces have to be translated and adapted to local requirements, local knowledge and feedback loops are most effective. Now the income, representing IP consumption, has to be split too. The estimation of income from software marketed to customers requires an estimation of future sales of copies of the software.

When setting up a CFC which depends on local sales, additional planning is needed. How well will marketing concepts transfer? How much effort at the CFC will be expended for local sales? That effort represents investments towards new IP, not useful to the original software. At the same time, the feedback to the originators can initiate changes that will greatly assist translation and adaptation. If, for instance, Unicode is used throughout the software, it becomes much easier to adapt to foreign alphabets. If the direction of print is a parameter, the efforts at the CFC for support of for languages such as Arabic is greatly reduced.

The estimation of income requires prediction of sales. This aspect is always risky, but even more so when operations are moved to foreign settings. Common ways include using information about foreign sales prior to establishing the CFC, data about predecessor products, estimates on the number of businesses that need the functionality of the new product, the number of customers who can afford the product, the number of certain type of computers or operating system in use, and similar bounds. A 50% penetration is considered optimistic and beyond that level, distortions in the market occur due to the ability to employ monopolistic practices.

5.6 Summary of software IP valuation

While it remains difficult to determine the IP value of software, reasonable estimates can be produced. In the setting of offshoring, additional factors have to be considered, but often relevant data are available from the period before offshoring was considered.

6. Outsourced Operations

Section 3.4 lists some of businesses operations that are often outsourced. Each of these is associated with specific types of intellectual property. After describing the principle of valuation of intellectual property, including software, a business case ‘for’ or ‘against’ outsourcing those components can be made, especially when offshoring to other countries. The type of entity, IFC versus CFC, used as a partner is also discussed.

6.1 Methods and risks of operating offshore.

Depending on the method of outsourcing chosen, the costs, benefits, and risks will differ. In any case, the value of the IP exports that will be needed to achieve the business goals should be determined. Information about the current operations can provide the quantitative information needed. If there is already an existing call center, there has been training experience; as such, there is a record of the information needed and of supplementary material that was produced. If some development has been outsourced, say for quality control, risks involved in expanding such tasks can be better assessed. There are cases where full development of novel software was outsourced to unfamiliar partners, with disastrous results.

6.2 Business Models

With reference to the models listed in Section 3.4, all of these activities exploit intellectual property that will be transferred. As the activities are transferred to an offshore site, the magnitude of the value of the relevant IP will be known, so that the additional risk can be quantified [Frank, 2005].

A. Many early outsourcing services provided **call-center services**. The business benefit to the owner is a reduction of required service costs, especially if the host is an off-shore operation. To help customers, both public information and confidential information are required. Protocols are provided that allow call center employees to be effective. Software that helps searching rapidly through complex system issues, based on terms that customers use to describe their problem, is commonly provided. The attributable income, or rather loss of income due to poor call center interactions, is hard to assess. Call center interactions can encourage further purchases, generating additional income, and hence additional value. Feedback collected in a call center operation serves as valuable input for further product improvements, and drives perfective maintenance. Both IFC and CFC models are in current use. Using an IFC as a call center may focus primarily on sales leads, and less on technology drivers.

B. Having the host provide **web services** moves the actual income generating operations to the partner. A web service model is attractive in part because it provides a means to protect the software itself. The source code may not be made available to the hosting partner, and the executing code is never visible at the customer site. In such a situation it is likely that call center, marketing and sales are also performed at the host. Here all the owners' income producing intellectual property is transferred, and generates income at the host site. For accounting reasons, having a CFC is preferable, but use of an IFC should be secure.

C. Having a remote host perform **localization of software** is effective since the required knowledge for adaptation to foreign languages and conventions may already exist in the offshored location. Operating independently can also give the specialists a stronger, and more coherent voice, important for doing the adaptation correctly. A difficulty though is avoiding excessive lag in the delivery of localized products. Since localization focuses on the interface, not as much deep knowledge is required. A good software architecture can keep the modules requiring localization to be isolated, and protect the IP. There is little risk to the product sales in the owner's region. When a software product is sold to a customer with global reach, having local versions becomes an important factor to all sales.

The choice of an IFC versus a CFC will depend on the degree of interaction that localization requires.

D. Some crucial **tasks in software development** are effectively performed by distinct teams, and these lend themselves to offshoring. Software quality control, i.e., testing is such a task, and often the prime candidate for offshoring a task in software development. Regression testing to ensure compliance with prior software versions is more easily isolated than testing for new software and features. For the new software intense communication is required, since it is rare that specifications provide an adequate roadmap. The balance of old and new will affect the choice of a CFC over an IFC,

E. **Shared development** of new software is a natural extension. Shared development allows software work to transcend time zones, leading to concepts such as a 24-hour knowledge factory [Seshasai & Gupta, 2006]. We have no experience with analyzing such a setting with respect to software valuation. Questions to be asked to arrive at a valuation would include the equivalence and metrics of the work performed. Are the partners doing the same type of work, or does the outsourcing focus on distinct components? Here we would expect that the host has access to all of the IP. To simplify the accounting, all costs will be aggregated. While an IFC can simply be contractually reimbursed, leaving all risks with the sponsor, having a CFC will require subsequent income allocation. Since there will by lag in the income generation, income distributions should be deferred [Wiederhold, 2008].

F. Creation of **new software** is actually simpler. If well-educated staff members are available, they will posses most of the required knowledge to translate concepts and specifications into programs. Having adequate and up-to-date specifications is a hard problem anywhere, so the risk here is not much greater. Knowledge about the potential market for the software should be shared to assure that the remote developers have the insight needed for the many decision that are not captured by the specifications. If the software is really novel and promising, establishing a CFC becomes the wisest choice. And extension of this aspect is having a remote Research center. These remote centers rarely focus on fundamental research, but typically perform substantial early development.

G. In order for a host to perform **software maintenance,** very deep knowledge has to be available [Basili, 1990]. For a software company, essentially all of its intellectual property outside of strictly marketing-related information has to be made available. If the transfer of IP is less than perfect, there is a high risk that new errors will be introduced, putting the owners at risk. Trademarks and marketing know-how kept at the originator provide the major means of protection. Establishing a CFC is preferred

H. Having the local CFC also perform **marketing and sales** in their region can be very effective. Now local expertise and IP are combined with the technological expertise of the owner. Being in control of sales staff also provides better two-way commincation. Any localization beyong initial translation will depend on local feedback. Having local sales personnel provides management with the leverage to create IP from local information, missing when sales staff can only sell what already exists. Accounting for income becomes more complex.

Any model will require a specific analysis. We specify two common approaches below.

6.3 Outsourced maintenance

If maintenance of an existing product is outsourced, case G above, then there tends to be an experience base that allows the valuation of the IP being transferred to the host. There is significant risk of creating disconnects. It is hard to transfer all the needed IP effectively, because all the background that led to decisions embodied in the code will not be fully documented. For instance, a reason for not employing a certain method is rarely documented. Such a determination may have been done, but it does not appear with the code, since another method was chosen and documented.

From financial analyses, we find that maintenance of long-lived software has substantial costs, but the resulting longevity of software provides major benefits to the owner. Quality maintenance is a major contributor both to software costs and software benefits. For much software, the cost of maintenance has exceeded the original investment within five years. It is commonly accepted that over the lifetime of software maintenance costs are 60-80% of total cost [Pigoski, 1997]. Managers with limited experience tend to bemoan the high cost of maintenance, since they are not clear about the benefits [Spolsky, 2004]. Education also ignores this cost component of software. The high costs make offshoring of software maintenance attractive.

If managed well, maintenance contributes major benefits, both in terms of income and to success in the market. Keeping a product competitive attracts new customers and keeps the existing ones. If maintenance is provided through licenses, say at 15% of the initial price annually, then, by year 10 the income from maintenance licenses will exceed the income from sales, as sketched in Figure 3 [Wiederhold, 2003]. Additional income can be derived from related services, as installation and training.

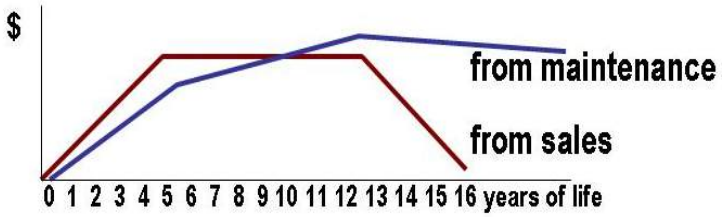

Figure 3: Income for a software company that charges maintenance fees

Input to the IP created during maintenance originates in many components of a business, customers, participation in standards committees, and business intelligence. When offshoring of maintenance is being considered, care must be given that these flows will not be hindered, so that the software retains its quality in the competitive market place.

We observed that successful software companies kept maintenance responsibilities with the creators, who are in a better position to respond and to enhance products than new hires or remote experts. It may be an illusion that cheap labor reduces the overall costs; it essentially reduces the benefits of maintenance [Landsbaum & Glass, 1985]. However, in a setting where novelty is valued above all, it is organizationally awkward to assign maintenance tasks to the best qualified staff.

Truly novel work is best done by new hires. For Case F above, the requirements for new software are much easier to circumscribe and hence to value as IP. Still, some assessment is desirable. Are only requirements transmitted, perhaps as obtained from marketing

staff? Are specifications included? Is prior software included to provide a model and reusable components?

6.4 Webservices and IP issues

Provision of Webservices, Case B above, presents new issues for IP valuation. A webservice is a functionality provided over the Internet to the users who require it. For example, a webservice can provide weather forecast information appropriate to a construction scheduling application [Wiederhold, Sriram, Liu, Law, Cheng, 2003].

To evaluate the income from webservices, the services offered must be metered and accounted. There should be a contract between the service requester and provider which describes the type of contract, duration of contract, security and other parameters [Kuebler & Eibach, 2001]. Contract types can require payment for use, lease, and subscription to the service.

The use of web services can simplify the IP issues as the conceptual and implementation details of a service remain with the service provider. The service internals, as the source code, design specifications, documentation, and proprietary data may remain under control of the sponsor. Thus, the internal IP is well protected, the only components of web service exposed to the customer are the functionality and the information provided in the user's manual.

An important component of a web service can be the distribution of data and information. Once delivered to a customer, the information is hard to protect. If the information is of value only while it is current, as weather prediction or stock prices, little protection is needed. But for stable data to be protected, only aggregated results can be delivered. Still, combining results from proprietary data allows inferring source information, and makes it liable for loss. The actual source data could be covered by copyrights.

If the service provides some visible innovative functionality, then the main IP protection is market position and a reputation for quality service through responsive maintenance. Legal protection of methods might be offered through patents. In an offshored operation, the benefits can differ for the sponsor and an offshored host. Again, income and IP has to be properly accounted and distributed.

7. Legal and Tax Consequences from Offshoring

Legal protection of offshored IP is still fluid and has to be assessed case-by-case. Choices of methods to be used require knowing the value of the IP. Also, since offshoring causes a redistribution of income, there will be consequences on taxation of that income, namely where and what taxes should be paid. For businesses that effect can be major, and tax consequences can determine both favorable and negative decisions regarding offshoring.

7.1 Restrictions of Transfer of IP

Outsourcing is a now a pervasive phenomenon in every field of business. We see outsourcing in Health Care, Telecommunication, Law, Scientific Research, and Banking. The presence of outsourcing is also visible in Governance and Military domains, often indirectly through contracting and subcontracting. In such enterprises, the customer company should be careful about transfer of IP because the information or knowledge which is being exported may be regulated by the laws, regulations, and legal practices that may not be obvious. The more public laws rarely spell out sufficient detail, so that

most issues have to be understood in terms of much more voluminous regulations, issued by various agencies.

For example, U.S. regulations like ITAR (International Traffic in Arms Regulation) and EAR (Export Administration Regulations) restrict the transfer of any technology or commercial item which could be linked to national security of the US. Such items can include data in any form, encryption algorithms, and proprietary software. These laws restrict such transfer of IP to persons or companies belonging to other nations. When a military organization gives work to the companies based in US, these companies may internally offshore work to other companies with minimal control. In such setups, the contracting company has to be aware of all the regulations and consequences of sharing/exporting IP. Some government work may be covered by `Buy America Act' rules. Subcontracts for such work are also hard to track and enforcement can conflict with applicable international committments.

The European Union (EU) has more stringent rules regarding Data Privacy than the US. The EU's Data Privacy Directive regulates transfer of any personal data to the country which is not part of EU. Thus, when entering into a contract with any country outside EU, the contracting company must make proper arrangements regarding data privacy. If a non-EU country provided personal data to a host in the EU and that personal data includes EU employees, the data might not be accessible by the original sponsor. The growth of the EU confuses that issue.

7.2 Tax Regulations that apply to Transfer of IP to and from CFCs

In most cases, there is an inherent export of IP associated with offshoring. When property is exported, it should be paid for. Such income should come back to the owners, to enable new investments, and to enhance the growth of the owners. Income from IP exports is also to be taxed [IRS, 1994]. When the value of that export is valued poorly, both the owners and the government loose. If the host receiving the IP is a captive company (a CFC or CFH), then the transfer of IP may not be visible on the umbrella company's books, since, if these books show anything, they show only the aggregate value [GOA, 1995].

If intermediaries in tax havens are involved the situation becomes more complex, and regulations, both of the home country and the using country have to be followed [Levey, Wrappe & Kung, 2006]. In the case of export to a CFH which resides neither in the owner's country nor in the country where the work is being performed, the amounts transferred to pay for the use of the IP can become invisible. The profits generated by the IP that has been transferred are then neither taxed by the country where the IP originated nor by the country where the IP is used. When the CFH resides in a so-called tax haven, considerable savings can accrue to the company. Some emerging countries are becoming aware of the effect. Recently, the Government of Korea has started to look into the issue for CFCs located in its country, since the companies that pay royalties to CFHs located in tax havens contribute much less to Korea's economy than companies that hold their IP locally [Business Week, 2006]. In countries with a surplus of labor, the increase of well-paying jobs by itself remains attractive, even if local corporate profits, and hence tax payments to support the local infrastructure, are non-existent or small.

The accumulation of income, and hence capital by a CFH, in a locale with little supervision, limits access to that capital by the actual creators and maintainers of the IP on either shore. The amounts involved are massive [Economist, 2000]. Often the funds are extracted as royalties from the country that is using the IP held in a CFH. In order to

transfer such royalties invisibly, Dutch intermediaries (Besloten Venootschappen, BVs) are commonly used, since The Netherlands levy no taxes on royalty transfers [Browning, 2007]. Such financial intermediaries then move profits from sales at the companies that use the IP into the set of 30 OECD countries, which accept each others tax regimes, depriving emerging and developing countries of tax income to grow their respective infrastructures [OECD, 1998].

The control by the stockholders of the company that is engaged in this type of compensation for use of IP is also reduced. Few annual reports inform corporate investors about off-shore capital accumulation, and current regulations allow avoiding having to make such disclosures. Only when such sheltered income is used for extreme purposes, as using the accumulated capital to acquire the base corporation and relocate it to the tax haven as part of an inversion, do such issues enter public discussion [Avi-Yonah, 2002]. Even then, the focus is on repatriation of financial assets. The IP which generates the income in the taxhaven, being poorly documented and understood, is ignored and will soon recreate new assets in the tax haven.

Our experience as of now is mainly with U.S. companies, but much offshoring occurrs in Europe as well, often to countries in Eastern Europe, but also to Asia [Kwiecinski, Peters, Hoch, 2006]. The formal situation is still quite unclear. In 2001, the German tax court ruled that companies cannot be required to provide additional documentation beyond what is in their accounting records [Roeder, Kroppen, Eigelshoven, 2002]. Since accounting records are woefully inadequate in keeping track of intangibles, this decision meant that no documentation would be available for the greatest part of the companies value, and their associated exports. Amendments were made in a German Finance Act of April 2003 to require more stringent documentation for transfer pricing (Konzernverrechnungspreise). Such emerging regulations must match regulations in other European Union countries. To come to a joint European position may be very difficult, since some members are primarily sponsors and others are hosts. However, the method relied on in our work does not rely on accounting records over intangibles, but merely on the effect that intangibles will have an impact on revenues, and those data are available.
Since this topic is quite new, applicable regulations are in a state of flux. As new taxation policies are adopted by countries with respect to IP and tax authorities in different countries become more knowledgeable about valuation of IP and software endeavors, companies with captive software development operations will need to be careful with respect to equitable valuation of software products and services. The issues have reached a scale that radical changes of legislation are being proposed to change taxation rules for CFCs both with countries and among OECD members [Dorgan, 2007]

Taxation is a zero-sum game, no matter what politicians promise. A failure to collect taxes for governmental services from one taxpayer causes other taxpayers to become disadvantaged. When outsourcing, the participants are not only the companies, but also the countries that create and use the intellectual property. Fair valuation of software plays an important role. The use of tax havens, which only hold, but neither create nor consume IP, vitiates the benefits that advocates of globalization hold forth [TJN, 2005].

8. Conclusions

The Internet provides a means to transfer intellectual property and capital, both important components of electronic commerce, rapidly and nearly invisibly. The effect is that businesses and governments can easily lose track of what is happening. This paper

provides an overview of issues and methods of analysis when intellectual property, specifically software, is transferred as part of outsourcing. The issues are complex, but must be managed as well as they possibly can, since intellectual property is the main driver of modern commerce, and its value exceeds manifold the book value of companies operating on the Internet.

The fact that the greatest cost and contributor to profit in many modern enterprises, their IP, cannot be placed on the books of the business that create and own hinders management of software businesses. Especially the maintenance that is needed to keep software useful should be accounted for simply as a cost of doing business. The cost of products being sold (COGS) is a primary concern in accounting. Classifying even the routine maintenance of software as research and development, as done now, distorts analyses, misleads corporate decision making, and reduces the shareholder's understanding of business tradeoffs. With current GAAP accounting rules, Internet companies providing computational services may have no cost whatsoever assigned to the goods they sell, and hence have unbelievable profit margins.

When tax havens are involved, the complexity increases. Most investors in a company will not be aware how intellectual capital interacts with income, since little reporting is required. The directors of technical companies, responsible to protect the shareholders, are typically technical experts, and will sign off on methods that reduce corporate taxes without understanding these processes, developed and operated by external taxation specialists, in depth. Since, when offshoring, tax-benefits and lower wage scales occur together, the financial effects are convoluted, and hard to sort out.

There are also cultural conflicts related to offshore outsourcing that are hard to capture in a business model. Globalization distributes benefits as well as risks, since the capability to react locally to problems is reduced [Maurer, 2004]. While corporations are treated legally as persons, they obviously are not. Humans can experience happiness without riches, once basic needs are met. It is hard to conceive of governments or corporations as such being happy, although the actions they take can affect human happiness a great deal, independent of the GNP they generate, the taxes they collect, and the shareholder wealth they create. The cultural aspects of property are diverse and worthy of further study [Small, 2003].

We have used the results of a valuation model to assess transfer of IP embedded in software when outsourcing takes place. We believe that transfer of capital, intellectual and monetary, should be taken into account when outsourcing is discussed. While transfer of jobs has a high emotional interest, the long-range aspect of intellectual capital transfer may well be of greater import. We summarize the salient points:

> **Valuation is essential to assess the investment needed for offshoring:** Obtaining proprietary software or other IP for an outsourced operation requires ongoing payments or an investment. A valuation is needed to determine the cost and the life of such an investment. The maturity of the software must be assessed to set an appropriate discount rate in making the investment decision.
>
> **Valuation is essential to assess the risk of offshoring:** With the continuing trend towards globalization, a company in a developed country is increasingly likely to have a piece of software developed in a country that offers lower costs.
>
> **Valuation is essential to assess the effects on taxation when offshoring:** If the operations at the foreign supplier require IP, then the export of such IP has to be

valued and becomes taxable income. Distortions will occur if the export is not valued correctly. Employing intermediary tax havens makes balancing effort and benefits pretty much impossible.

Valuation of software is not easy, and requires many assumptions. But it can be done adquately, and not valuing IP when offshoring is worse than approximating the value in a reasonable and documented manner. The cost-benefit and risk analyses required for outsourcing software and software production depend on such valuations. Having a documented quantitative model allows rapid re-evaluation of offshoring when labor rates, product prices, sales volume, available IP protection, and tax regulations change. Without a model, decisions about alternatives will be based on undocumented and rapidly obsoleting assumptions, a situation not acceptable in a rapidly changing world.

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This work is based on the confluence of material from many contributors. Only a few were cited. Many more are listed with the full version of [Wiederhold, 2006], available at http: infolab.stanford.edu/pub/gio/inprogress.html#worth.

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