Date of acceptance Grade

Instructor

Global software development

Nikita Zhuk

Helsinki March 27, 2008

Seminar report

UNIVERSITY OF HELSINKI
Department of Computer Science

HELSINGIN YLIOPISTO — HELSINGFORS UNIVERSITET — UNIVERSITY OF HELSINKI

Tiedekunta — Fakultet — Faculty	Laitos — Institution — Department
Faculty of Science	Department of Computer Science

Tekijä — Författare — Author
Nikita Zhuk

Työn nimi — Arbetets titel — Title
Global software development

Oppiaine — Läroämne — Subject
Computer Science

Työn laji — Arbetets art — Level	Aika — Datum — Month and year	Sivumäärä — Sidoantal — Number of pages
Seminar report	March 27, 2008	18 pages

Tiivistelmä — Referat — Abstract

As globalization of markets expands, many software companies move their development work to offshore countries to achieve cost savings. The often used argument in favor of offshoring is the lower salary level of offshore workers. The public opinion of these engagements tend to be negative — software development in offshore hotspot countries like India or China is often seen as low-quality, low-productivity work. Offshoring seems to affect negatively onshore employees by lowering their morale and customers which get dissatisfied with lower-quality products.

This paper examines both advantages and challenges which are related to global software development from company executive or project manager point of view. Real-life data of salary, performance and quality levels of different countries as well as age structures in different countries is used to provide some empirical basis for theoretic considerations.

ACM Computing Classification System (CCS):
K.6.0 [General]
K.6.1 [Project and People Management]
K.6.3 [Software Management]

Avainsanat — Nyckelord — Keywords
economics, management, global software development, offshoring, offsourcing, processes, follow the sun

Säilytyspaikka — Förvaringsställe — Where deposited

Muita tietoja — övriga uppgifter — Additional information

Contents

1 Introduction

To survive and prosper, each industry is constantly seeking out ways to improve their efficiency and competitiveness. The idea of moving various industries to another location to achieve some economic advantage has been around for over 230 years, since Adam Smith's publication of "The Wealth of Nations" in 1776 [Smi76]. In 1970s and 1980s computer hardware manufacturing companies especially in USA moved major parts of their operations overseas [Ann04]. In the early 1990s, with millions of kilometers of fiber cable laid around the world, the trend continued with legacy system maintenance, which was moved to Canada, Ireland and India.

Software development costs have risen steadily since software systems have become more complex and part of nearly every aspect of business and everyday life. Larger, more complex software systems require naturally more labor to be specified, designed, implemented and maintained, since software development is often labor intensive activity. The cost of infrastructure (such as server hardware, software licenses, network infrastructure etc) does not vary much between countries, so wage cost becomes a major economic factor which drives globalization of software development forward.

Software development has been migrating from Western countries such as USA and Western Europe countries to countries such as India, China, Russia and Eastern European countries for many years [Ann04]. Gartner has described the recent development as "irreversible megatrend" [Mor03] and that "globalization is inevitable" [Lye04]. Ensuring software compliance with year 2000 gave a boost to offshoring industry, since there were severe skill shortages in the USA and Europe [Ann04]. Although major Y2K problems were prevented successfully [Fin00], results of these projects were mixed [Ann04]. Organizations noticed that labor cost savings were accompanied by a mixture of problems and completely new challenges.

The use of global software development offers the potential for cost reduction, larger pool of talent, around-the-clock development and some other benefits, but is also brings variety of risks and challenges in communications, quality management as well as in legal and economic issues [Ann04]. Global software development also places an emphasis on software development practices which vary between countries and may produce different results [CMKC03a].

This paper will first present the basic terms and models of global software development in chapter 2. It will then examine the possible advantages and benefits which may be achieved with global software development in chapter 3. In chapter 4 we will turn to various challenges of global software development and examine some countermeasures to overcome those challenges. All findings presented in this paper will be summed up in chapter 5.

2 Global software development

In this chapter we will define the main terms related to global software development and examine what types of projects are usually developed globally. Terminology in the rapidly developing field of globalization is still evolving, and there are lot of different terms used to describe different forms of this phenomenon. Literature is using terms *outsourcing*, *backsourcing*, *offshoring*, *nearshoring*, *farshoring*, *inshoring*, *onshoring* and *homeshoring* [Ann04]. There are also terms such as *twoshoring*, *multishoring*, *rightshoring*, *brain drain* and *brain gain* [McF05]. In a field with such a vast terminology it's important to set clear objectives to the discussion by concentrating on just a few aspects of globalization.

In this paper we will concentrate on offshore sourcing or offshoring, which means a transfer of responsibility for any IT service to the same or another company based in another country. Offshoring includes both near- and farshore sourcing, which simply means that countries which do provide these services may be located either near or far [Ann04]. Offshoring may be contrasted with offshore outsourcing, which means a transfer of responsibility for any IT service to another company based in another country.

The main hypothesis of globalization of IT service industry is that IT skills, knowledge and services can be delivered competitively across country borders, time zones and business entities [Mor03]. In offshoring any IT service, including planning, management, application development and operations may be transferred to another country [Ann04]. However, offshore outsourcing is currently mainly used in application development and application maintenance, which together constitute only 25% of the total IT budget, while infrastructure roles and skills, which constitute 40% of the total IT budget, are not widely outsourced [Mor03]. The main emphasis of this paper will be on offshoring of application development.

Current literature shows that current types of offshore application development is mainly "low value, low risk" kind of work, which encompasses non-core and commodity development and testing [Hue06]. However, many offshore service providers try to move up in the value chain. Large offshore IT service providers specialize in IT, investing heavily in training and in developing sound processes [Ann04]. Projects which demand those skills due to skill shortage in home country may also benefit from offshoring. Over 40% of 5231 executives of American and European IT companies reported that they moved offshore because of need of technical skill sets and to gain industry expertise [Hat05].

3 Advantages and benefits

Offshoring industry wouldn't be growing at current rates if it couldn't offer any advantages to companies considering offshoring. Although when making offshoring decisions none of advantages should be considered in isolation, without risks and challenges associated with them, it's beneficial to examine each advantage first and then add risks and challenges to the discussion, so that both sides of the coin would be brought up. This approach will be taken in this paper. This chapter will present advantages which are possible to achieve with offshoring. Chapter 4 will concentrate on risks and challenges.

Although the most popular reason for offshoring is strictly economical, i.e., cheaper labor force, there are also other possible reasons for consider offshoring. As other countries gain skills and experience in software development processes and methods, the pool of software development talent becomes global and it may provide missing technical skill sets or industry expertise [SS06, Hue06] or improve quality by providing more formal processes [Ann04, CMKC03b]. Time zone differences may provide benefits by distributing work so that software development progress would happen around the clock, by "following the sun."

3.1 Cost reduction

The main appeal of IT offshoring is cost reduction via lower labor cost [CW08, Ann04, Hat05]. For example, in India, which was the first mover and is now the undisputed leader of the global offshore services industry, the average annual salary of a computer programmer is 4 000 EUR - 8 500 EUR (although an Indian profes-

sional with three to five years of programming experience can earn 18 500 EUR), when the average salary of a computer programmer is 47 800 EUR in US and 44 900 EUR in Britain [CW08, Ann04]. Average annual salaries of computer programmers of these and other countries are shown in figure 1.

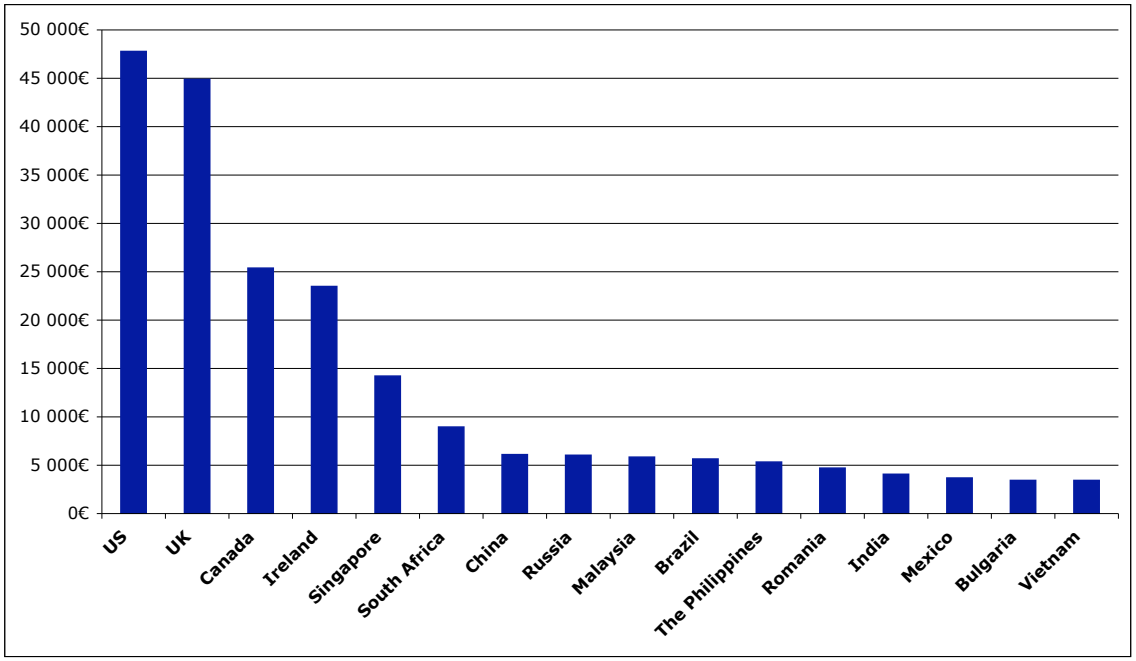

Figure 1: Average annual salaries of computer programmers [CW08, Ann04]

3.1.1 Salary levels

Salary statistics presented in figure 1 are based on year 2004 data. However, as demand of these offshoring services is on rise, salary levels are changing as well, and we'll see higher salary levels in these countries [CW08]. For example, some Central and Eastern Europe countries such as Poland, Slovakia and Czech Republic have seen annual growth in real wages (wages adjusted by the consumer price index) from 5% to 10% after European Union Eastern Enlargement in 2004 [DBo07, BW06]. The newest EU members Bulgaria and Romania have seen annual growth in real wages up to 17%.

Differences in salary levels between home countries and countries offering offshore services have traditionally received too much focus [Ann04]. Although some savings can be achieved via salary differences, the majority of savings in successful offshoring engagements comes from internal process improvements and vendor exe-

cution [Hat05]. In fact, in Ventoro Institute survey of 5231 IT companies' executives only 9% of cost savings came from lower salary levels, while process improvements and vendor execution accounted for the rest 91% of savings.

3.1.2 Process improvement

Process improvements introduced as part of the offshoring program can be major factors in cost savings. Software engineering in countries offering offshore services tend to be more formal and process-oriented, and outsourcing firms invest heavily in processes and certifications such as CMM, ISO and Six Sigma [Hat05, CMKC03b]. For example, Indian vendors of 24 software projects reported that they used detailed designs and design reviews in 100% of those projects and had made architectural specifications for 83,3% of those projects [CMKC03b]. Amongst 31 of American vendors those numbers were 32,3% for detailed designs, 77,4% for design reviews and 54,8% for architectural specifications. Also more than half of all the firms in the world with CMM level 5 certification are located in India [Mat05].

It seems that offshore companies tend to use these formal processes and certifications as a signal of quality when bidding for contracts [CMKC03b]. However, mere CMM compliance doesn't mean that the quality of software which is produced by the company holding some certain CMM level is guaranteed to be high. Jay Douglass, an executive of Software Engineering Institute at Carnegie Mellon University said that even CMM level 5 organization can produce software which might be garbage [Mat05]. In fact, a study of 89 companies which were rated at CMM level 5 has found that those companies' projects had higher error rates than projects of firms without CMM assessment [Koc04].

Based on the study of 5231 IT companies' executives, Ventoro Institute's recommendation is to concentrate on the concrete cost and performance metrics collected during the project instead of just trying to comply with processes and certifications [Hat05]. However, in practice this isn't always possible, since certain CMM level may be required by the client (for example, the United States Department of Defense requires a certain CMM level for all bidders of their projects) [Koc04].

3.2 Global talent pool

Countries with emerging offshoring service markets has skillful, well-educated people which outnumber those in countries such as USA and Western European countries.

For example, several Eastern European countries have strong mathematical and scientific schooling based on Soviet educational traditions, and highly skilled professionals in these countries which may have previously worked for the state are now seeking for employment in private sector [Ann04]. Asian countries like India and China has relatively young population when compared to aging population in Western European countries and USA. For example, the median age of computer programmer is 24,4 years in India, 23,8 years in Malaysia and 31,8 years in China, while it's 36 years in USA and 38,7 years in Britain [CW08].

Higher levels of formalism and process-driven software engineering used in offshore companies described in chapter 3.1 may force the home customer to develop its own processes to be able to work efficiently [Hat05, Ann04]. When responsibility for software development is moved from home country to the offshore country, the detailed, formal specification of systems becomes critical. This may help to reduce the risk which comes from incomplete specifications and from the reliance on "silent knowledge" of in-house individuals. This kind of introduction of structured methologies and procedures can be also seen as a transfer of knowledge from offshore countries to home countries.

The access to global pool of skillful developers gives also flexibility to the company in home country, since it can increase or decrease its development capacity as new projects are started and old ones are completed [Ann04]. If new projects demand skills which are not available instantly (either completely missing or if people with required skills are already working on other projects), it may make sense to seek the missing labor force from the global talent pool. This, in turn, increases the potential supply capacity of the company in home country.

3.3 Follow the sun

Another often mentioned advantage in global software development is working around the clock, also called *follow the sun* model [Ann04, Hat05, Mat05]. The idea is to base offshore centers in many different countries around the world in different time zones, so that after work day has been finished in one time zone it could be continued in the next one, and so on, extending the working day to as far as 24 hours, without paying anyone overtime.

Working around the clock can be used in software development where there are clear stages of work which can be handed off from one team to another after one

stage of work has been completed [Mat05]. Such example could be software testing, where fully designed and implemented, maximally independent unit or component could be sent to another time zone for testing while the implementing team leaves the office. The testing reports and lists of bugs found would then be waiting the implementing team next morning. Another popular application of "follow the sun" model is in help desk, where support services of software are provided by offshore locations around the clock, so global customers of the software product can always get support regardless of the time zone they're in [Ann04].

While continuing to work around the clock sounds good in theory, it has been rarely successful in practice [Hat05, Mat05]. In fact, it often causes inefficiencies which outweight possible advantages, since the transfer of knowledge which happens during the handoff of work units between time zones requires more communication effort and is rarely complete [Hat05]. The more globally dispersed teams communicate about the daily handoff, the less time there's left for actual productive development work. Also, if work units which are handed off are not "final", i.e., the team which handed the work unit off will continue working on that unit after another team's work shift is over, then there can be problems in both teams to get on top of the progress made by another team. The design or implementation assumptions as well as some ideas of future development which teams make may not be always clearly written down in documentation (e.g. different preferences of resolving similar problems with different design patterns), so developers must use their work time each day to understand the changed code base.

4 Challenges

The growing popularity of global software development may remind the Gold Rush which happened in 1849 in California - now thousands of gold seekers have just been replaced with thousands of software development silver bullet seekers [Hat05]. Global software development is still in relatively early stage when compared to global delivery of IT services, so there's still a lot of experimentation going on [SS06].

The fact is that although offshoring can offer significant advantages in software development, successful adoption of it requires deep understanding of all the challenges involved [Hat05]. It also requires detailed planning before moving development work offshore or dividing work between globally dispersed teams. Sometimes offshoring may not be a correct answer to the problem at hand, and adopting it may just make

things worse [Hat05, Lye04].

In Ventoro Institute survey, 53% companies which had offshoring engagements either didn't achieve any cost savings or did actually increase costs as much as by 27% because of offshoring. The overall average costs savings were slightly below 10%. Over 33% of companies had to move at least part of offshored work from the offshore locations back to the home country because of performance problems. Some other surveys report savings from 10% to 44% [Mat05]. A total of 48 unique risks were also identified and reported in a sample of 25 journal articles [CW08].

These statistics show that simply throwing software development to another country doesn't mean cost savings. This chapter will examine challenges which are related to global software development. Although offshoring has a lot of economic and even political challenges, the focus will be on challenges which are related to project management and software development.

4.1 Human Factor

The value of people in any software development work is often underestimated [Hat05, DL99]. As Tom DeMarco and Timothy Lister wrote in Peopleware, "*we are mostly in the human communication business*" — major problems of our work are sociological in nature [DL99]. All the work gets done by people – processes and tools don't work for themselves. If offshoring strategy is process-driven, i.e., processes are defined first and team members are selected later to fill in the gaps in the process just as any other interchangeable productive factor such as infrastructure and tools, then the probability of success is considerably lower than in case where the best possible people are chosen first and then a process is built to facilitate those team members in accomplishing their job [Hat05].

After the best available workers have been found and a team has been built, the turnover rate must be minimized. Yearly turnover rates in offshore hotspots tend to be quite high (e.g., 35%-40% in India) [Hat05]. High turnover rates do cause obvious costs such as startup costs of new employee (finding, hiring, training), which can be around three lost work-months per new hire [DL99]. In addition to those visible costs there're also hidden costs which may be caused by too short-term viewpoint. If workers don't stay long enough in the company, there's no reason for company to invest heavily in that persons training, his/her working environment or team building.

In some offshoring hotspots there may be an attitude that working for USA and European companies as a outsourcing service provider means a boring job and no growth opportunities [Hat05]. Many companies in offshore countries are now aiming to offer higher value services and are wanting to become close business partners not just in software implementation and testing but also in higher-level architectural design and project management. This attitude together with the fact that offshore countries tend to be employee-driven (i.e., skilled employees have the power to choose their employer from several possible options and not the other way around as it's often the case in USA and Europe) is raising the premium which must be paid for skilled, motivated offshore employees.

Booming offshoring industry and employee-driven markets are one factor which cause higher turnover rates [Hat05]. However, turnover rates can be reduced by choosing carefully which parts of software development should be moved offshore. There're studies that show that moving the job which no one wants to do from home country to offshore country will increase costs significally when compared to keeping that work onshore.

Onshore company must also consider the career growth possibilities for offshore workers to reduce turnover and to attract the most motivated employees available [Hat05, DL99]. If the company is ready to commit to each worker's career growth by providing clear growth plans and widespread retraining opportunities, the worker feels that he/she is really expected to stay and can achieve his/her future goals without changing the company in the future [DL99]. Companies with lowest turnover tend to have widespread retraining programs and high investments in personal growth of employees.

In addition to keeping the motivation up in the offshore team, the offshoring impact on onshore employees should be considered as well. Any move to carry out work creates anxiety about job security and future career growth possibilities onshore [Ann04]. It lowers the morale of onshore programmers and makes it more difficult to hire new, good programmers [Mat05]. Retraining workers who have lost their jobs to offshore to some other task doesn't always work, since different positions in software development require not just different skills, but also different personalities. Forceful retraining of skilled employees may raise the turnover rate to up to 80% [Hat05]. It may also make it more difficult to incubate skillful managers in-house, since the fewer in-house programmers there are left after offshoring, the fewer ones can be promoted to the managerial level [Mat05].

Impact on the onshore team can be mitigated by clearly defining both short-term and long-term plans, which should be presented to the onshore team, explaining the objectives of the offshore strategy and how each onshore employee fits into these objectives [Hat05]. Career growth paths should be planned with each employee before moving offshore, so they're assured that their job security isn't under threat. Since offshoring will require new skills from onshore team — different management style, communication and cultural issues, new tools etc — the necessary training should be given to the onshore team to reduce the possibility of problems which will in turn cause job dissatisfaction associated with offshoring.

4.2 Cultural issues and communication

Cultural differences between onshore and offshore countries and communication problems between globally dispersed teams is a real challenge which still exists, although some outsourcing vendors claim otherwise [Hat05]. In Ventoro Institute survey 9% of offshore outsourcing strategies failed because of these issues — cultural and communication issues had more impact than geopolitical ones. Global software development brings together people with different historical backgrounds, different expectations about working relationships and norms used in daily working life [Ann04].

Most offshore countries have business culture which places emphasis on leadership and management hierarchy [Hat05, Ann04]. In USA and European companies it's quite normal for employee to question his/her authority and to put forward his/her own suggestion as a signal for willingness to take additional responsibility. Titles and job descriptions in USA and European countries don't tend to restrict employees' tasks as they do in offshore hotspots. Also offshore employees may be unwilling to take suggestions from other employees which are not indicated as their official managers by the organizational chart. Because of these reasons defining clear job descriptions and management hierarchy is important, and reports show that it helps to avoid problems [Hat05]. In Ventoro Institute survey lack of clearly defined leadership was the root reason for failure in 16% of failed offshore outsourcing strategies.

Forcing the cultural adoption by trying to adopt the culture of home country offshore hasn't brought good results [Hat05, Ann04, Mat05]. The same holds also other way around — adopting the culture of the offshore country onshore has caused disastrous results and should be avoided. As usual, the answer lies in the middle — both teams should aim to enhance cultural awareness and understanding and to

learn the business culture of other team by spending some time with each other. Sending onshore employees to the offshore facility and inviting offshore workers to visit onshore site is a strong tool to break down cultural barriers.

Distance and time zones between teams also place additional requirements to the tools which should be used to arrange the required information in such ways that it would be accessible to all parties interested in it. Various online project management tools such as issue trackers, wikis and various knowledge base products become even more important when teams are globally dispersed. Daily communications between teams may be handled via synchronous methods like teleconferencing, videoconferencing, instant messaging and real-time chats or via asynchronous methods such as e-mails and traditional documentation. The transfer of documents between teams isn't enough, because documents won't be used to transfer "tribal knowledge" of the team — those random discussions at water cooler which build the base for future decisions. Informal communication is also important in breaking down cultural barriers especially when it doesn't concern work, because it allows getting to know people in other team on more personal level.

Arranging synchronous communication between time zones has its own challenges. Both onshore and offshore teams will have to adjust and meet in off hours from time to time. It's important to not force either one of the teams to absorb the adjusted work hours, since it will cause severe morale problems [Hat05]. The better solution is to rotate the off hour burden on a periodical basis between the teams. Extra cost of such overtime should be included in the cost-savings calculation of an offshore engagement.

4.3 Performance and quality

Some articles express major concern with performance of offshore team and quality of the software they produce [Mat05, CMKC03b]. Ventoro Institute survey supports these assumptions — 15% of failed offshore outsourcing engagements failed because of performance problems with the offshore team [Hat05].

Performance and quality data of 104 software projects from a global software process survey are displayed in figure 2. It should be noted, however, that the performance is measured by counting lines of code, which is a controversial metric for performance [FP98]. The survey shows that output levels in India were lower than in other countries participating in the survey, but defect levels were comparable to those in

USA and lower than in European countries. However, the survey sample is rather limited (India was the only popular offshore hotspot country studied) and it's not representative of broader population of projects in each region [CMKC03b].

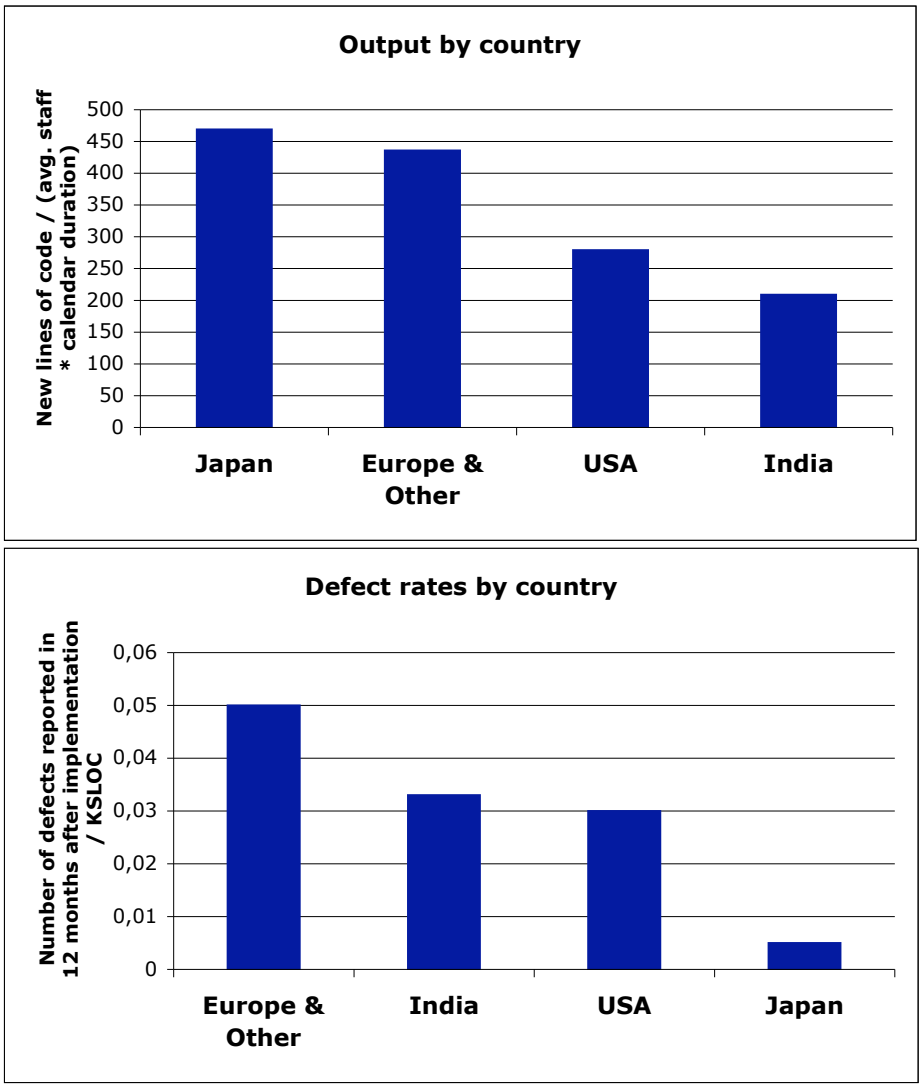

Figure 2: Performance data from Global Software Process Survey [CMKC03b]

4.3.1 Performance measurement

Measuring performance of software development is a very wide topic and cannot be covered completely in this paper. However, sound performance measurement is critical in global software development so that the success or failure level of offshoring strategy could be decided based on relevant information [Hat05]. There's no single

performance metric which defines the total success level of an offshore strategy or any other development work. It's especially tempting to concentrate on such simple metrics like *lines-of-code / work-time* or *offshore hourly seat cost*, or rely on CMM level of an offshore vendor as a guarantee of high performance and quality, but these single metrics don't provide any insight into such issues as total cost, additional risk stemming from team morale problems and higher turnover, customer satisfaction, software quality and so on.

Many managers don't establish a performance baseline for the work which they're going to move offshore [Hat05]. Such a baseline should provide at least rough metrics about performance and quality of software produced onshore, so that it would be possible to compare the performance and quality of software produced offshore. Ventoro Institute survey found that 37% of IT company executives couldn't state their performance or quality baseline in even the most simple metrics like cost of line of code or defect density of the code. DeMarco argues that the cost of employee turnover is also rarely measured in software organizations, and since offshoring includes a risk of higher turnover, these costs should be estimated as well [DL99, Mat05]. Ventoro Institute recommends that the turnover tolerance level in offshoring engagements should never be below 5% [Hat05]. Demonstrating cost savings or software quality change of offshore engagement is impossible without established baseline metrics even if good performance and quality metrics are collected after the offshore engagement.

4.3.2 Problem solving ability

The performance level observed in hotspot countries like India and China may not be captured that well by simplistic lines-of-code per man-months metrics as it's done in figure 2. Public opinion about performance and problem solving ability of software workers in those countries is usually quite negative [Hat05, Mat05, Ann04]. The problem seems to be real, but it's not rooted so much in cultural issues but it's a simple consequence of dilution of qualified workers in those countries [Hat05]. It is usual that companies which offer offshoring services minimize their costs by using young, inexperienced programmers [Mat05]. This fact can be seen in age statistics of those countries which were mentioned in chapter 3.2.

The idea of this model is to have few experienced, senior developers and engineers who could divide complex programming project into small and simple pieces which these young programmers could then implement [Mat05]. However, in Ventoro Insti-

tute's research there were 25 executives who complained about their offshore team's weak problem solving skills [Hat05]. In each of those cases there were no experienced senior developers in the team, so the relative lack of experience of young developers either adversely affected quality or resulted in lot of questions from developers to the client. Having skilled developers in each team has huge impact — DeMarco argues that best people outperform the worst people by about 10 times and the median people by about 2.5 times [DL99].

4.3.3 Processes

A Global Survey of Software Development Practices by three universities and Hewlett-Packard concluded that the use of early betas and prototypes was associated with higher output and lower defects. In addition to that continuous regression and integration testing and conducting design reviews were associated with lower defects [CMKC03b]. Ventoro Institute survey indicated that use of prototypes offered also the highest probability of success of offshoring engagement, as well as use of PMI and RUP project management models [Hat05]. When prototypes were used in requirement definition, application design and transitioning to the offshore team and when many iterative releases were used during the development, the success rate of offshoring engagements was much higher when compared to traditional waterfall model.

As mentioned in chapter 3.1.2, quality standards and certifications such as ISO, CMM and Six Sigma are popular in offshore hotspot countries. However, these standards are not substitute for project management methodology such as RUP or agile project management models [Hat05]. There're also often situations where offshore vendor and onshore client use different project management methologies and they argue about which one to use. Ventoro Institute found that exclusive use of client or vendor methologies without compromises didn't work. Long-term success was best achieved by developing a new, hybrid methodology which included key components from both client's and vendor methologies [Hat05].

4.4 Hidden costs

In addition to extra costs which stem from cultural awareness training, extra communication costs, possible performance issues and the adoption of new processes, there're lot of hidden costs which are not so apparent but should be still included in

total cost vs. savings calculations of offshore engagement. In the very beginning of an offshore initiative the evaluation of potential vendors and selecting one of them incurs costs - from 0.2% to 2% of the annual cost of the deal [Ove]. These costs occur because vendors should be evaluated based on their industry expertise and technical skills, project requirements should be documented so that vendors could make bids based on them etc.

Ventoro Institute also recommends to conduct aggressive research campaigns for the most promising vendors [Hat05]. During those campaigns client should contact customers of these vendors and assess each vendor's true level of expertise, integrity and problem solving skills. Site visits and employee interviews can be also conducted.

After the vendor is selected, partnership must be bound by a legal contract. Legal contracts which span two or more countries and legislative systems are more complex than single-country contracts, and additional legal advice is needed to cope with those complexities [Ann04]. Although the theft of intellectual property is often seen as a high risk in offshore engagements, its damaging impact seems to be rather limited — in fact, all of the most damaging IP theft incidents seem to occur inside USA and Europe [Hat05]. However, evaluating security policies and procedures of offshore vendor is still needed and it causes extra costs [Ann04]. Also costs of managing those contracts, invoicing, auditing and making sure that vendor time is properly recorded should be considered [Ove].

5 Summary

The current "irreversible megatrend" of global software development seems inevitable [Mor03, Lye04]. Software companies seeking to improve their efficiency and competitiveness are turning to offshoring to achieve cost savings, continuous development and a global talent pool. In addition to the most obvious possibility for savings — labor costs — companies can achieve much larger savings by process improvements and efficient, high-quality vendor execution [Hat05].

However, global software development is still in relatively early stage — a modern version of Gold Rush — and there's still a lot of experimentation going on [SS06]. The fact is that although offshoring can offer significant advantages in software development, successful adoption of it requires deep understanding of all the challenges involved [Hat05]. Cultural and communication issues, motivational problems, time zone differences, inexperienced developers, quality problems and various hid-

den costs should be taken into account when planning to move software development work offshore.

Without detailed planning before moving development work offshore or dividing work between globally dispersed teams there's a high risk of failure. It should be also noted that offshoring isn't the correct answer to every problem — some problems are resolved better onshore. Companies seeking cost savings of 50%-70% are just being unrealistic - the average cost savings reported in various surveys had been from below 10% to 44%. Measuring the success level of offshore engagement requires sound performance and quality metrics which should be collected before and after offshored projects. However, many companies fail to establish a baseline performance which could be compared to metrics from offshore projects, making the managers which make offshoring decisions basically blindfolded [Hat05, DL99]. However, while there're a lot of challenges and a lot of warning examples, there're also many companies which do achieve success. This paper doesn't take a stanse for or against offshoring - it's a very powerful tool which can be used to improve efficiency and competitiveness of a company if all relevant challenges are considered and sound baseline performance is established.

References

Ann04 Anne, E., *A Guide to Global Sourcing - Offshore Outsourcing and Other Global Delivery Models.* The British Computer Society, 2004.

BW06 Baldwin, R. and Wyplosz, C., *The Economics of European Integration.* McGraw-Hill, 2006.

CMKC03a Cusumano, M., MacCormack, A., Kemerer, C. F. and Crandall, B., Software development worldwide: The state of the practice. *IEEE Softw.*, 20,6(2003), pages 28–34.

CMKC03b Cusumano, M., MacCormack, A., Kemerer, C. F. and Crandall, W., A global survey of software development practices. *Forthcoming, IEEE Software.*

CW08 Chatfield, A. T. and Wanninayaka, P., It offshoring risks and governance capabilities. *HICSS '08: Proceedings of the Proceedings of the 41st Annual Hawaii International Conference on System Sciences*, Washington, DC, USA, 2008, IEEE Computer Society, page 436.

DBo07 Annual database on eastern europe, 2007. URL `http://www.wiiw.ac.at/e/annual_database.html`.

DL99 Demarco, T. and Lister, T., *Peopleware : Productive Projects and Teams, 2nd Ed.* Dorset House Publishing Company, Incorporated, February 1999.

Fin00 Finkelstein, A., Head-to-head: looking back at y2k. *Computing Control Engineering Journal*, 11,4(Aug 2000), pages 156–157.

FP98 Fenton, N. E. and Pfleeger, S. L., *Software Metrics: A Rigorous and Practical Approach.* PWS Publishing Co., Boston, MA, USA, 1998.

Hat05 Hatch, P. J., Offshore 2005 research: Preliminary findings and conclusions. Technical Report, Ventoro Institute, http://www.ventoro.com/Offshore2005ResearchFindings.pdf, 2005.

Hue06 Huen, W. H., An enterprise perspective of software offshoring. *Frontiers in Education Conference, 36th Annual*, pages 17–22.

Koc04 Koch, C., Software quality: Bursting the cmm hype, March 2004. URL http://www.cio.com/article/32138.

Lye04 Lyengar, P., Application development is more global than ever. Technical Report, Gartner, http://www.gartner.com/resources/124000/124025/application_dev.pdf, 2004.

Mat05 Matloff, N., Offshoring: what can go wrong? *IT Professional*, 7,4(July-Aug. 2005), pages 39–45.

McF05 McFedries, P., Words in the wind [new tech terms]. *Spectrum, IEEE*, 42,4(April 2005), pages 80–.

Mor03 Morello, D., The organizational implications of offshore outsourcing. Technical Report, Gartner, http://www.gartner.com/resources/118100/118136/118136.pdf, 2003.

Ove Overby, S., The hidden costs of offshore outsourcing. URL http://www.cio.com/article/29654.

Smi76 Smith, A., An inquiry into the nature and causes of the wealth of nations, 1776. URL http://www.adamsmith.org/smith/won-index.htm.

SS06 Sharma, S. and Seshagiri, G., Point/counterpoint. *Software, IEEE*, 23,5(Sept.-Oct. 2006), pages 62–65.