Outsourcing in Software Development

From Trend to Norm: Insights on the Outsourcing Revolution

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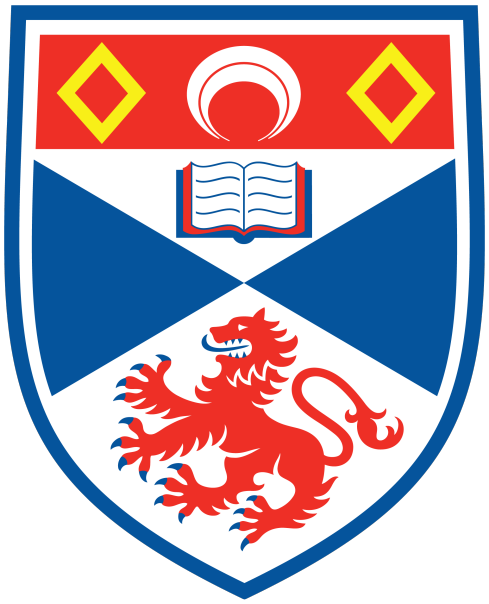

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CS5030 Assignment 2: Group Research and Report

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Word Count: 3931 words

October 13, 2021

Contents

I. Introduction

Outsourcing is everywhere. Companies buy services from local distributors, establish relationships with specialists, and tie business relations with international partners. As a natural part of the economy, outsourcing of software development is no exception.

i. Roadmap

In this report, our objectives are to introduce and critically evaluate both the pros and cons of outsourcing in software development, as well as engage in a discussion about possible solutions to challenges and future trends. After this introduction, the second section contains an overview of outsourcing with regard to software development. Additionally, motivations to, and a brief history of outsourcing is covered. The aim for this section is to set the scene for more in-depth analysis as we move on. The third section then explores benefits of outsourcing in an IT context, covering topics such as reducing costs and benefits to developing countries. The fourth section explores latest trends in Information Technology Outsourcing (ITO), while the fifth section discusses challenges including cash flow, communication, control, privacy, and technical bottlenecks. It can be argued that the benefits of outsourcing are quite simple and straightforward. We have therefore chosen to limit the third and fourth sections to a few core examples, while diving deeper into the challenges. Each challenge is elaborated with a possible solution to the issue. The sixth and final core section describes future trends, giving an outlook on what the future of software development outsourcing might look like.

ii. Purpose

Overall, outsourcing in software development has grown to be more of a norm than a trend with businesses all over the world. This report therefore aims to create a holistic image of the topic, while elaborating sufficiently on some select topics.

II. Background

i. Outsourcing: An Overview

Outsourcing, as discussed by Eber, is an effort by a given business to improve its efficacy through hiring an outside supplier to be responsible of a business activity that would otherwise be produced by the business itself [1]. In other words, it is a decision taken by a firm faced with the choice of either buying from an outside partner or building the product or service themselves [2]. Furthermore, according to Hodosi and Rusu (2019), "outsourcing is a contractual agreement including interrelated and ongoing exchanges and responsibilities" [3]. Outsourcing covers domains such as Business Process Outsourcing (BPO), Application service provisioning (ASP), software sourcing, or, more recently, open-source software (OSS) [1]. With regard to outsourcing software development, Information Technology Outsourcing (ITO) encapsulates the business process outsourcing of software, information technology (IT), and the services linked with the domain [1]. While many definitions for ITOs exist in academic literature, this paper will use the concepts of outsourcing software development and Information Technology Outsourcing interchangeably, as they largely overlap in their general definition [3].

A firm's outsourcing decisions can range anywhere from domestically bought IT services to international development agreements with multiple and simultaneous service providers [2]. A decision to outsource some components of a firm's product may come due to a desire to cut costs, or perhaps from a desire to improve performance [4, 5]. Moreover, Lacity et al. (2017) claim that the result of an ITO venture is not simply a "success" or "failure", but rather an intricate balance of costs, performance, and service quality [2].

Outsourcing of software development can take many forms, be driven by a range of motivations, and comes with both clear benefits

and unpredictable challenges.

ii. Motivation for Outsourcing

In his 2007 paper, Bordoloi draws a fitting parallel between a firm's decision to outsource a portion of its product and the economic reasoning for the benefits of international trade [6]. Simply put, countries benefit from trade with each other due to their differences and specializations. Thus, it is mutually beneficial for two countries to focus on their respective expertise and access other products by trade. In the 1990s, this notion was conveniently encapsulated by Peter Drucker, who reportedly advised firms to "do what you do best and outsource the rest" [7].

Since software development can be modelled as a for-profit product, it can be considered a modern-day case study of sourcing decisions in a globalized economy. Alike other industries, software development companies may choose to outsource parts of their business to cut costs, increase efficiency, or access more qualified professionals.

Similarly, a company could combine a range of needs. For example, it could focus on its own expertise in-house and outsource parts of the product that the company is not as proficient at building. Regardless, all motivations behind software development outsourcing share one factor in common: profitability.

iii. History of Outsourcing

Agrawal et al. shed light on the history of outsourcing by observing the evolution of offshore outsourcing in India [8]. Outsourcing in IT dates as far back as 1963, while the commencing of offshore outsourcing to India can be traced back to 1979. According to Agrawal et al., so-called "traditional outsourcing" aimed primarily at cutting operational costs and largely concerned none-core activities. Eventually, outsourcing motivations came to include buying more critical services and products, as new incentives sprung up, such as efficiency, flexibility, and trustworthiness. Today, ITO has grown to be an integral part of many business' strategies.

III. Benefits of ITO

In the 21st century, software development outsourcing has become an increasingly viable business strategy for companies around the world. As seen in Figure 1, by 2006, Finland, Norway, and Denmark had all crossed the 70% threshold for the share of local enterprises having outsourced at least some of their IT functions to an external supplier [9]. Expanding on the topic, this section will cover some of the most prominent benefits of outsourcing software development.

i. Business Solutions in Focus

i.1 Human Resource Costs

A significant cost for any company is its expenditure on personnel. Since the cost of hiring programmers in a specific location is governed by local prices, the hiring costs for software companies that are based in large cities or expensive countries cannot compete with cheaper labor markets. Data from the United States Department of Labor shows that the weekly median wage for software developer jobs in the United States was $1,653 in 2019 [10], while in India the average annual salary for programmers was only around $5,300 [11]. Consequently, a company could employ a programmer in the United States labor market for three to four weeks for the same salary they could employ an Indian programmer for an entire year. This significant gap in costs naturally incentivizes companies to outsource and save money.

i.2 Buying Expertise

Software development is a large and complex process that involves both IT-related personnel and collaboration with users in the software application field to determine the requirements for the software and the details of its

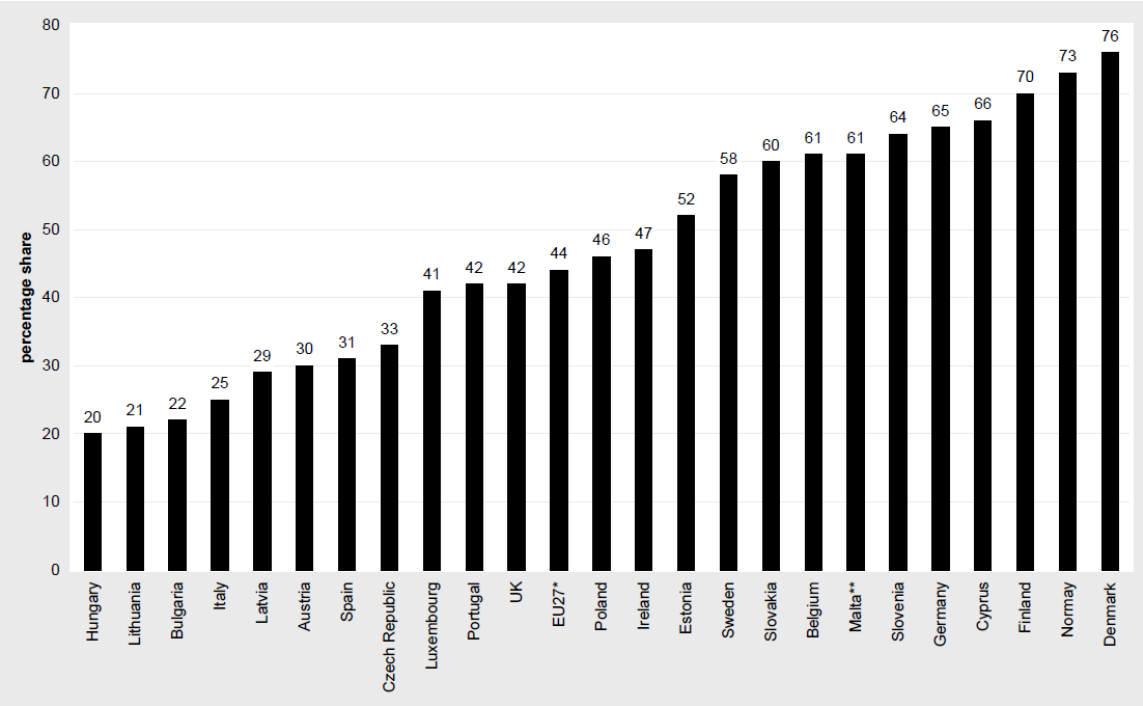


Figure 1: *Outsourcing of IT services in the EU in 2006 [9]*

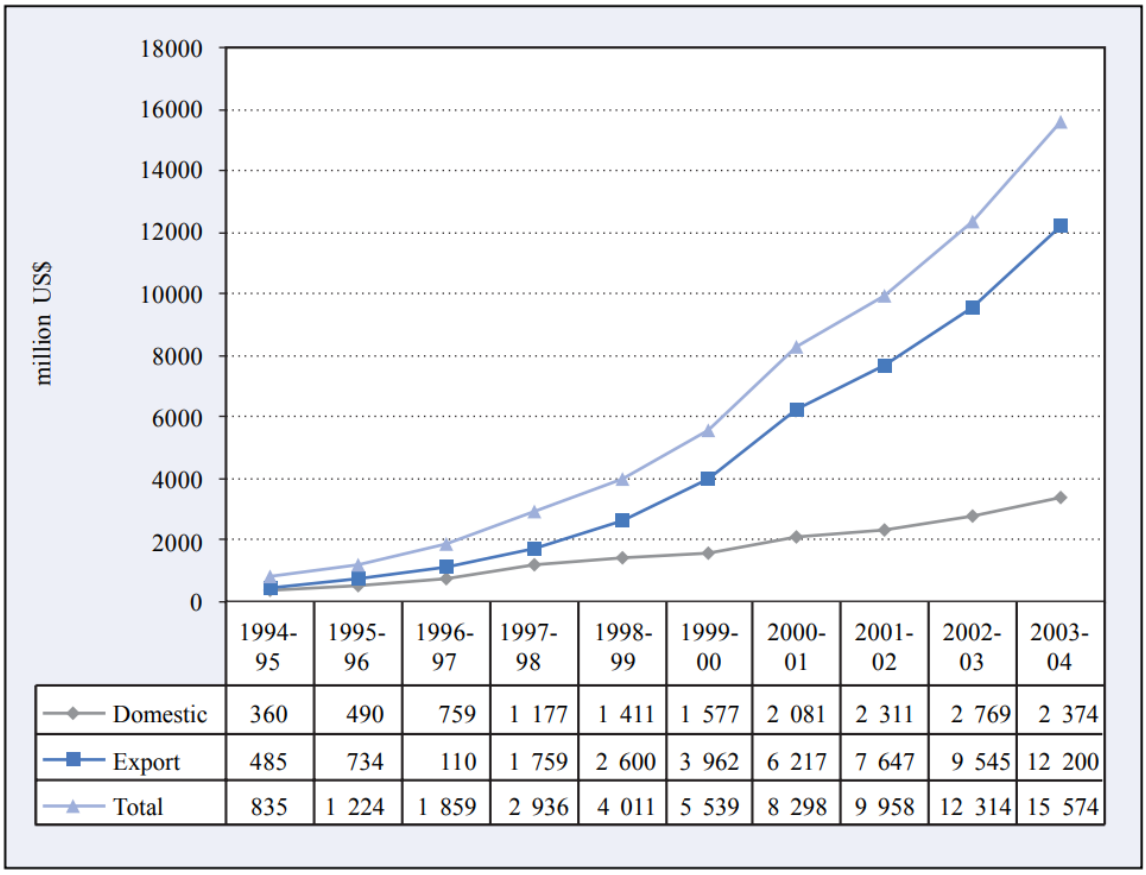
specific functionality [12, 13]. In the case of medium and large software development, for example, a development project may have a massive code base and many access mechanisms, connections, and operations. Team members also may need to master different programming languages and methodologies, product knowledge, and processes, such as Software Development Life Cycles (SDLCs) [12]. Hence, if a company wants to reorganize its development team, the feat is significant, involving staff recruitment, personnel management, equipment management, and coordination between multiple departments. The final cost could result in a 30% reduction in profits [14]. Therefore, outsourcing software development can significantly reduce management costs and risks for companies.

Similarly, a number of companies do not need programmers on a permanent basis for ongoing development [15]. Instead, a company may need to develop a one-off software project that will be used for a long time, or perhaps run an IT service or maintenance on the side of their product. If the company is not specialized in the field themselves, outsourcing can be beneficial as it avoids hiring new personnel, setting up new units from the ground up, and reorganizing resources. Essentially, it allows the company to focus on its core competencies, while the outsourcing partner can offer any combination of specialized knowledge, staff, and affordability [15].

ii. Growth for Developing Countries

Software outsourcing has brought significant dividends to developing countries, especially India. Due to the country's vast number of highly educated people, almost all of whom speak English, India has become the country of choice for software outsourcing for European and American companies [4]. This part will utilize India's situation as an example to illustrate the benefits brought by software development outsourcing to developing countries.

Outsourcing software development to India has been a normal state of affairs over the last



	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
Domestic	360	490	759	1 177	1 411	1 577	2 081	2 311	2 769	2 374
Export	485	734	110	1 759	2 600	3 962	6 217	7 647	9 545	12 200
Total	835	1 224	1 859	2 936	4 011	5 539	8 298	9 958	12 314	15 574

Figure 2: *Indian software production exports and domestic sales between 1994 and 2004 [16]*

two decades [16]. Since the 1990s, many companies in the US, Japan, and other developed countries shifted their software development tasks offshore. As a result, India's economy received a significant developmental boost. As Figure 2 shows, India's software industry exports accounted for nearly eighty percent of total revenue from 2003 to 2004, and these exports were almost 19 times higher than in the prior decade.

The World Bank [17] has conducted extensive research on India's information and communications technology, which has been dominated by software development in recent years. This is shown in Figure 3. From 2000 until the outbreak of the COVID-19 pandemic, India's gross exports in information and communication technology increased year by year, rising continuously from $5.02B in 2000 to a peak of $78.52B in 2017. The dashed line in Figure 3 is a fitted linear regression of the data, showcasing a steep upwards trajectory of growth in ICT service exports for the time-period developed countries have outsourced their software development to India.

Over the years of growth in the ITO industry, the government gained tax revenues to invest in education, infrastructure, and development. Over the past two decades, India has seen a 20% increase in elementary school student enrollment [18], an increase in average life expectancy to 70 years [19], and a 23.4% decrease in the share of people living in poverty [20]. As figures 2 and 3 illustrate, a key contributor to these dramatic economic changes was undoubtedly the software development industry taking on outsourced activities.

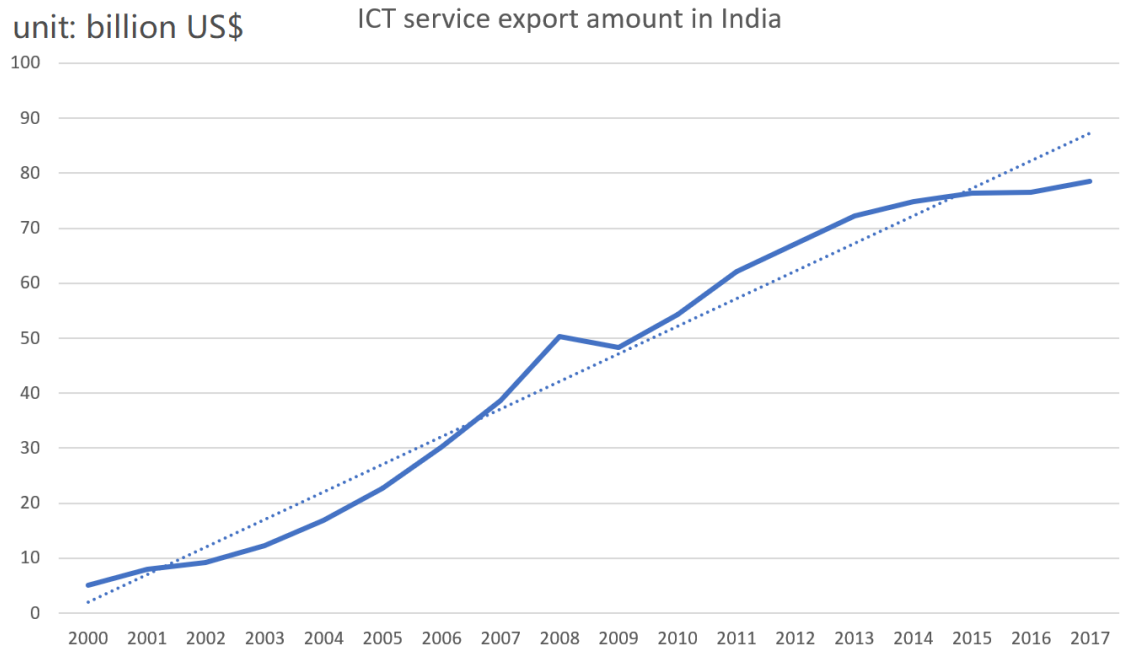


Figure 3: *Indian Information and Communications Technology service exports between 1990 and 2020 [17]*

IV. Latest Trends

Having covered some of the prominent benefits of ITO, this section will elaborate on the recent changes in the industry.

i. Consumer-Driven Outsourcing

In the past, the ITO industry was dominated by outsourcing enterprises with little to no resources expended on consumer feedback. In fact, most consumers only participated in reviewing the product requirements specification before the project was implemented (pre-demand stage) and verifying that the project was implemented correctly after its completion (post-verification stage) [21].

However, recently, power has shifted from the outsourcing enterprises and into the hands of the consumers [22]. This is because high quality technology and service is currently one of the important conditions for outsourcing recipients [4]. Today, many outsourcing enterprises act as prisms, combining external resources and concentrating them sharply on the needs of the consumer [23]. For projects that demand high quality, many consumers today are involved in every stage in the process and are often depended on to lead outsourcing enterprises to complete projects. This not only helps the products meet the consumers' needs, but also reduces the risk of creating an undesirable product [24, 25].

ii. Industry Standardization

According to a study of 25 large US organizations with a combined $50B of outsourcing contracts, the majority of the US industry (around 70%) appears to have a negative experience with outsourcing. The main reason is due to a lack of evaluation criteria to determine the best candidate for outsourcing. In other words, companies were frustrated with the outsourcing industry since it was difficult to determine the best outsourcing candidate for a project [26].

Presently, developing a common industry standard is vital for the outsourcing industry to solve any confusion that arises in the out-

sourcing process. Outsourcing standardization includes pricing standardization, process standardization, and quality standardization.

Pricing standardization is accomplished through segmentation and generalization. Segmentation is the process of subdividing a business until it can be combined at will and cannot be further subdivided, while generalization categorizes the results of segmentation and calculates the final price based on the subdivided categories. On the other hand, process and quality standardization involves following criteria to ensure a product is created in a particular way and meets a particular standard. For instance, for any organization to be a software contractor for a United States government agency today, it must comply with the Federal Information Processing Standards (FIPS). This standard contains many process and quality standards, such as data security regulations [27, 28, 29].

V. Challenges

As outlined above, ITO has become a global norm with benefits that would be easy to take for granted. Nonetheless, any business activity comes with its challenges. With regard to ITO, this section depicts some of those challenges.

i. Cash Flow

For both the client and the team providing the outsourced service, a major challenge in outsourced development is the issue of cash flow. For the service provider, its income often comes entirely from providing the outsourced service. If the stream of money then breaks, the provider may struggle to continue its work, the team may disband, and the client may end up with a half-finished product [23]. Even worse, this capital chain may break for some small and medium-sized enterprises (SMEs) purely due to unexpected circumstances. Naturally, if the service provider is not paid, the effort has not been lucrative [30].

ii. Communication

Ideally, software development teams should have sufficient communication between members, follow the same corporate culture, and have the necessary development skills and experience [31]. However, if the work is outsourced, cultural differences and time zone differences between the client and vendors may arise, which makes communication challenging [32]. In addition to cultural differences, issues with languages are also common [33]. For instance, incorrect translation may hinder the project localization process and cause communication problems between outsourced and core staff. Similarly, separation by geographical distance requires tools for communication between clients and vendors, and the exchange of ideas cannot take place efficiently in real-time.

Holmstrom stated that the temporal distance can be narrowed by letting everyone work in the same place, or co-location. Another possible solution to overcome the cultural gap is to formalize communication [31]. While an official, written form of communication makes communication more cumbersome, it also ensures it is precise and easily understood, with no room for ambiguity or misunderstanding.

iii. Control

There is a growing body of evidence that outsourcing endeavors fail due to the high level of risk associated with alliances compared to 'in-house' activities [34]. In outsourced work, since the customer cannot monitor the progress of the outsourced party in real-time, the product of the outsourced work is likely to deviate from the requirements or have substandard quality. This could be countered by having the customer dispatch personnel to monitor the situation in real-time. However, this would require a significant investment of resources and could incur substantial overhead that may outweigh the benefits.

Khan states that a "poor monitoring system" is the most challenging issue for clients [32]. Hence, the design of a management control system is vital to overcome such threats.

Since the client requests a specific product, the client could solve the problem of inadequate supervision by refining the terms on the contract and defining the target of work precisely — the client does not need to know the workflow of the service provider and only desires the outcome. However, life is full of accidents, and contracts are a very definitive tool. It is therefore very difficult to simply sign a contract to solve every problem. Kim [32] believes that trust is a compulsory component in the outsourcing process. Monitoring can thus be achieved by relying on the monitoring of the production rate and the clients' controls. Furthermore, broad non-specific contracts help maintain control by specifying the development time. Lastly, a high level of information sharing and communication are also a vital part to achieve full control.

iv. Privacy Protection

Today's society revolves around data — whoever owns the data is most likely to be the winner. Unfortunately, both the collection and storage of data requires significant overhead [35]. However, due to the existence of cloud computing, processing and storing data has become relatively simple [36]. As a result, some SMEs choose to outsource their data collection and storage processes to reduce costs.

Nevertheless, service providers cannot always be trusted. When a service provider is attacked externally or internally, or if the integrity of the provider is not trustworthy, sensitive company data can be compromised, incurring serious consequences. For instance, Facebook suffered a data leakage that affected 3 million users, causing massive damage to the reputation of the company [37]. As a result, addressing privacy issues that can arise in outsourcing software development is critical for every client.

The issue of privacy is not difficult to solve, but it is compulsory. Islam suggests that the outsourced data should be stored in an encrypted format, where users query the data without requiring decryption [38]. Lee and his team, in turn, tackled solving the problem by creating a way to preserve the privacy of sensitive data by proposing a secure query processing scheme over the encrypted data, which represents both higher query processing performance and higher query result accuracy while preserving data privacy [39].

v. Technical Bottlenecks

Integration is an enduring theme in the software industry. The reason why the code of some software companies cannot be outsourced is not because the management level cannot keep up, but because of technical challenges.

v.1 Legacy Systems

Traditionally, companies adopted monolithic software architectures where all components are combined and deployed together. While many companies are currently migrating to more modular approaches such as microservices for increased scalability and fault tolerance, the core systems of many companies are still relying on these monolithic legacy systems [40].

As a result, it may not only be difficult for outsourcing teams to contribute to these rigid systems, but will also increase the software's technical debt as it will be hard to monitor and debug any changes to the system. For instance, if there is a bug in the core system, it may be left unnoticed, or it may be impossible to determine which service is responsible for it [41].

As a solution, a company could migrate its core systems to a modular architecture, and thus any outsourced plug-ins could be encapsulated and easily observed [42]. For instance, an outsourcing team may be able to interact with the core systems through a well-documented API interface rather than altering the core systems themselves. In this case, the core implementation would not need to be disclosed, which may be necessary for security reasons.

VI. Future Trends

Over the last decade, the ITO industry has grown steadily. In fact, the global average IT budget used for outsourcing software increased from 10.6% in 2016 to 11.9% in 2017 — a record year for ITO expenditure across Europe, the Middle East, and Africa [3]. Despite the COVID-19 pandemic disrupting virtually every business, this figure has continued to rise, increasing from 12.7% in 2019 to 13.6% in 2020 [43].

Due to the massive growth of ITO, as well as the widespread digital transformation of organizations driven by COVID-19, there are several future trends that emerge for the industry.

i. Increased Competition

Today, software giants are growing rapidly and increasing their quantities of outsourced code. Although the outsourcing industry is booming, the number of outsourcing teams is increasing much faster than the number of outsourcing projects [32]. As a result, market resources are abundant, leading to a more diverse and competitive market.

i.1 Emerging Markets

Currently, among the software development contractors, Indian companies lead the world in market share. Most of the outsourced software development projects of software companies today are given to Indian software development companies [23].

However, it is likely that in the next few years, we will observe software giants increasingly outsourcing non-core projects to China, the Philippines, Eastern Europe, and other regions with very low human resource costs [44, 45].

To minimize cultural, linguistic, or geographical differences and improve coordination between companies and their contractors, nearshoring is becoming more popular. This is the act of outsourcing to a nearby country, as opposed to a distant one. For example, a company based in the UK may decide to outsource to Eastern Europe, rather than Asia [33, 46].

i.2 Rise of Freelancers

As COVID-19 transformed remote working into a societal norm and pushed companies to adopt technology, it also encouraged them to be more accepting of hiring skilled freelancers.

Since 2009, the number of digital talent platforms has shot up from 80 to over 330, which is expected to continue rising in a post-COVID-19 society. With freelancers at the fingertips of companies, it is easier than ever to outsource software development on-demand, further increasing the competition in ITO [47].

ii. Data Security

As companies continue to embrace technology post-COVID-19, they will also need to ensure they comply with data protection laws and have defenses against data theft and other forms of cyberattacks. Today, the cyber insurance market is growing rapidly, and is expected to increase from $7.5B in 2020 to $20.4B by 2025 [48].

With regards to outsourcing, this could result in a greater market share for countries which comply with particular directives. For instance, Eastern European nations in the European Union (EU) might become more popular outsourcing destinations as they are required to follow the General Data Protection Regulation (GDPR) by EU law [49].

iii. Robotic Process Automation (RPA)

Robotic Process Automation (RPA) describes the automation of service tasks, such as manipulating data or configuring software, which were previously done by humans [50].

In the future, RPA may be widely used as a cheap, speedy, accurate, and reliable solution for ITO. Sarah Burnett at the Everest Group claims that "Robotic Process Automation is the

next wave of innovation, which will change outsourcing. We already are seeing the beginnings of a race to become the top automation-enabled service provider in the industry. In time, we are likely to see an arms-race for innovation in automation tools leading to new offerings and delivery models" [50].

iii.1 GitHub Copilot

While RPA is only used for well-defined and repetitive tasks today, such as processing transactions, it is possible that massive breakthroughs in Artificial Intelligence (AI) may pave the way for automating software development.

Recently, in June 2021, GitHub Copilot was announced — an AI tool created by GitHub and OpenAI to help software developers write code. Powered by a new AI system known as Codex, it attempts to convert code comments directly into its respective source code. Since it is trained on billions of lines of code, it is able to create complex programs simply from their descriptions [51].

While it is still in its infancy, GitHub Copilot shows us that RPA may be the next step for software development outsourcing.

VII. Conclusion

In conclusion, this report has explored the well-established but rapidly changing field of software development outsourcing. The objective of the report was to introduce the reader to a very multifaceted topic, while maintaining an in-depth perspective and sufficient specificity.

After an initial introduction and road map of the report, the second section covers the background of the topic, its context, general motivations for outsourcing, and finally a brief history of outsourcing, utilizing India as an example. The third section discusses the benefits of ITO, with a division between perks for businesses and a societal example. In short, outsourcing may bring benefits such as cheaper labour costs, access to expert professionals, and reduced costs compared to if a business set up a specific service themselves. The societal case study examines India's prominence as a source for outsourced services, and how ITO has contributed to the overall increased welfare of India over the past two decades. Covering latest trends in software development outsourcing, the fourth section discusses how much of outsourcing has evolved to draw upon consumer sentiments in the firms' business modelling. Additionally, the notion of industry standardization is explored, with an emphasis on streamlining outsourcing to a common standard across categories. After latest trends, the fifth section highlights challenges such as cash flow issues, communication disruptions, and privacy. In a globalized and fast-paced world, outsourcing may be seen as a convenient bandwagon to hop on, which makes the challenges section especially important to highlight. With each challenge, a solution is therefore presented. Finally, the future trends section wraps the report up by exploring multiple different notions of trends to come.

Collectively, the six sections come together to constitute a holistic depiction of outsourcing in software development, and illuminate many unique but equally relevant aspects of ITO.

[3931 words]

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