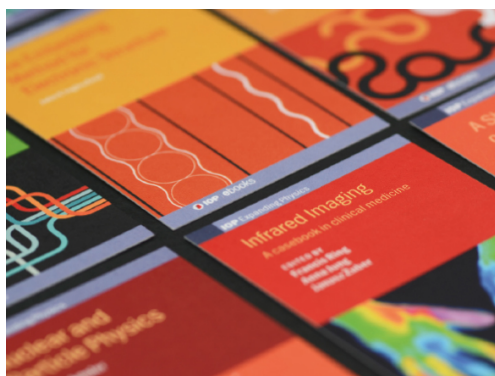


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Economical competencies for IT professionals

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Abstract. A modern specialist in the field of IT technologies must inevitably be conversant with the economic environment in which he or she conducts their development work, as well as to be familiar with economic processes and financial data, which can be related to the work as a whole and to some of its aspects. Therefore, an IT specialist should be competent in economic theory, management and marketing, as well as risk management. The peculiarities of today's fluctuation functioning of objects in the world economy bring some new requirements for the level of training in such disciplines, as Mathematical methods in Economics, Cyclical processes and Economic forecasting. This research paper presents an argument for a certain minimum knowledge, skills and competencies that are needed in order to increase the competitiveness of an IT specialist. And some basic knowledge in law science and English language must be added to this minimum. The paper summarizes the experience of teaching Economics and economic-mathematical and predictive models for future specialists, as well as the experience of young IT specialists.

1. Introduction

Nowadays, careers related to IT sphere, are gaining more and more popularity both among students that are still at the crossroads of their life, and among adult persons who decide to radically change their life and sphere of activities. At the same time, today the main resource is not so much information or material things, as the employees' level of expertise. Competitiveness of the majority of IT companies is based on knowledge and experience of their employees [1].

Contrary to popular opinion, an IT specialist is a rather wide-ranging concept, which includes not only programmers themselves, but also representatives of many different professions in the field of information technologies. IT professionals also include administrators, database architects, and IT-project managers, business and system analysts, testers, information security specialists, designers and many others. Moreover, every day new information technologies become adapted to new spheres of business, thereby creating new workplaces and professions for those who are willing to devote themselves to the world of IT.

Every year institutes and universities increase the number of education programs related to IT and allowing its students to build a successful career in the field of information technologies in the future. Also, we can see how popular those programs are by looking at such professional options as "Business Informatics", "Information security", "Intelligent information processing systems", "Computer science and engineering", etc., where the rate of students competing for each place is quite high [2]. This can be proven by the increasing number of applications for IT courses in a number of Moscow and regional universities. For example, at the Higher school of Economics, according to the results of the recent admission, the increase in the number of applications for courses related to Information technology



accounted for 71% compared to the previous year. In St. Petersburg State University for some (e.g., "Modern programming") the odds were about 60 to one. Also, the faculty of mechanics and mathematics of Lomonosov Moscow State University has been extremely popular for many years, with almost 4,000 applications submitted, while enrolling rate of less than 400 people.

HR specialists working in various IT-companies say that one of the key factors when hiring young specialists on a certain position is a specific or relevant university degree. Many companies are welcoming successful graduates even without any job experience, if potential employees have good computer skills, are familiar with the architecture and basics of building information systems, are good at business modelling and have mastered the basics of system analysis.

When entering a university for an IT program, a lot of students mistakenly think that their curriculum will only consist of disciplines related to programming, cryptography, and other computer sciences. However, it is further from the truth, and very often their first courses are devoted to Macro - and microeconomics, Management, Law, Project management and other economic subjects, as well as economic and mathematical methods and models.

2. Problem statement

IT specialists that develop computer programs for various business operations need to be familiar with specifics of the company's core activities; this may include financial analysis, for instance, in banking, or certain data calculations for insurance companies. Such knowledge will help to build the most appropriate approach to software development, implementation and maintenance.

Often in job offers placed on specialized websites, such as hh.ru, among the job requirements one can find such items as:

- knowledge of product financial models would be an advantage;
- experience in financial analysis is appreciated;
- knowledge of the legislation of the Russian Federation regulating relations in the banking sector;
- knowledge of taxation and financial legislation;
- experience in banking projects, general understanding of accounting and banking;
- knowledge of project management basics;
- experience of working with payment systems and interbank transfers will be a big advantage;
- work experience in the sphere of finance (insurance companies, banks).

Such requirements as the ones mentioned above make it clear that in order to get a job in the field of IT technical skills would definitely not be enough. Up-to-date economic expertise accompanied by some relevant practical skills might be needed as well.

3. Results and discussion

Let's take a closer look at some of the economic knowledge that is currently more relevant than ever for IT professionals.

Basically, an IT specialist, apart from some legal knowledge and a high level of English, should have a systemic level of knowledge in micro - and macroeconomics, management and marketing, risk management, mathematical methods in economics and forecasting. This would create not only a good background, but also a good basis for a long-term stay in the IT services market and one's professional career.

Basics of law science and legal studies. This discipline is undoubtedly important for any person living in accordance with the state legislation, but in this case I would like to put a special emphasis on the basics of data protection law, There is a number of legal acts that regulate the issues connected with software development, information security, electronic document flow, personal data processing and several other relevant issues. Without basic knowledge of legislation and legal documents in this field one can easily become a subject to criminal and even administrative liability. By the way, we should not

forget about the bonuses. This type of knowledge will be quite useful when completing a patent obtainment procedure.

English. This skill is undoubtedly among the key ones, especially for programmers, administrators, and system architects. In the first place, all technical aspects are described using English names; programming languages also involve English words for a number of functions to be named. However, there is one more point: the majority of really valuable and relevant books and publications on modern information technologies have not been translated or the translation is so poor that it can bring even more confusion than help. That is why in 90% of cases preference should be given to publications in the original [3].

Economic theory (micro - and macroeconomics). Just like in any business direction, IT business requires knowledge of how to calculate the potential profit or payoff of a project or service. In most cases, opening a specialized department in the company is not enough for effective data processing because the financial experts' lack of software development skills it is impossible to conduct reliable and adequate data analysis. Very often IT managers need knowledge in economics and finance because their responsibilities may include such tasks, as investment estimation, planning and control for budget, economic assessment of value for a project or provided service. When evaluating investments, we consider it necessary to take into account their innovation saturation (the ratio of R&D costs to the investment flow as a whole) and the integral innovation effect (the product of partial effects with corresponding weights for each factor), according to the method proposed in [4]. This sets the framework for a general understanding of the need for expenditures and their volumes.

Knowledge of the economics of a modelled and programed object. When developing each product, you have to take into account both general and specific characteristics of the object. Overlooking special features of the object can significantly reduce the value of the work that is carried out. Therefore, we find it crucial that students of IT courses get familiar with the basics of sectoral and regional economy. The course should not be large, but it must include knowledge about the external and internal conditions of the object and their peculiarities.

Management and marketing. One should also remember about skills in project and product sales management. Experience has shown that it is former developers who are the most capable of doing IT projects, as no one is more aware of the development processes, as they are. Yet, programmers sometimes lack knowledge and skills in management, control and team building. There have been some cases when a good software product has been already put into the market, but brings almost no profit. This indicates the lack of marketing professional, or their poor qualification that would have helped them to sell at a good price and to attract a larger number of consumers. That is exactly the knowledge that can be acquired at marketing and management courses. And another course called "Innovation management" is also becoming more and more popular nowadays, as it considers specific features of IT market in more detail [5].

Risk management. The world of IT technologies consists not only of programmers and software developers, to provide effective functioning and stable profit for an IT business, there are certain managers needed. Those are the managers that are deeply aware of modern information technologies area. But at the same time management is always accompanied by some risks, especially when it comes to such an important, but actually not that material resource, as software [6]. While taking certain managerial decisions one should be able to weigh all the pros and cons of such decisions and do it carefully and accurately, as the IT market is one of the most rapidly developing ones, so a mistake today can cost you not only invested time and money resources, but also can lead to a collapse of the entire business in the future. Mathematical risk assessment takes into account various aspects of possible damage: statistical, fiduciary, strategic, and unavoidable heuristic and pragmatic aspects. Failing to take those aspects into account can lead to significant losses for the business.

The instruments which are used in modern economic research. Mathematic methods in Economics as a science have come a long way for the recent years. This is especially true for cyclical processes and forecasting technologies. During the process of forecasting, one should not only try obtain a specific quantitative assessment, but should also be able to identify the type and special features of the process

that determines the dynamics of the digitalization object. Here you need to know how to identify the area of objective opportunities, and within this area – the area of opportunities that are suitable both for the developer and the customer. That is why it might be useful to increase the level of economic and mathematical training of IT specialists, as very often mathematics used by IT specialists today, especially when it comes to digital modeling, is not complicated enough and cannot fully reflect processes that take place in economics and management. [7]. Here, simulation models have proven their effectiveness, because they allow you to accurately describe any business process, if we are talking about business Informatics. Together with neural networks, which are often used for obtaining short-term results, and cyclical models, they comprise a whole instrumental minimum for digitalized economic objects forecasting.

Of course, we are not speaking about simple and conventional methods here. Furthermore, the attitude towards econometric models and cross-industry balance models for forecasting purposes is rather too optimistic. There isn't any successful forecasting system based on econometrics or cross-industry balance method. In the context of increasing fluctuations in the economy and R&D sphere, capabilities of the latter are becoming increasingly limited.

MEPhI has gained considerable experience in this field, e.g., by building its own digital double of an enterprise. This model uses so called oriented graphs to simulate various processes in the enterprise, which also have high-level prediction capabilities.

Moreover, while developing a software product, the main focus should be put on its target audience. No matter if it is a business entity or private users; anyway, knowledge of specific features of an industry or type of activity which an IT project is aimed at is a key to successful development project completion on the whole. No matter if it is a bank or a private entity, without enough awareness of the core business activities of the company, it is impossible to develop a software product suitable for the customer company [8]. This is probably why "Business analyst" and "System analyst" courses have become one of the most popular ones in the IT market in 2020. For quite a long time in Russia, these professions were underestimated, and trying to economize on resources, company managers used to think that it was enough to pass the requirements directly to programmers and leaving them alone struggling to figure out how to translate them into program code. However, this is absolutely not right. Analysts are in some way "translators" between customers and programmers, because only an educated analyst can model company's business processes properly, it is only him that can offer more optimal solutions, and most accurately convey the main idea and requirements for a new software product to the software developer. At the same time, these professions are quite profitable. For instance, analyzing the offers of IT companies from the website hh.ru for the "Analyst" vacancy, we can say that a specialist with only 1-3 years of experience can safely receive a net income of 150-250 thousand rubles. Moreover, the work would involve a five-day work week working week with a full social package. Thus, choosing the profession of an IT specialist, can bring you confidence in your future.

In this case, the specialist should be offered specialized courses in industry and regional Economics, management and marketing. These courses are also required for digitalization of different research areas. But here, the course will concentrate on industries (and their types of activities) in the field of R&D.

Another important aspect of the IT sphere is huge career opportunities. Of course, it doesn't mean that after a few months of working as a programmer, you will get the opportunity to become the CEO of a company [9]. But at the same time after several years of hard work as a developer or analyst, you can get promoted to the position of the so-called Team Lead, or, as it is usually written in record books, "Head of direction". And this position requires not only technical, but also managerial skills, which are taught in management and management courses.

Thus, there can be formed a complete system of economic knowledge which will be necessary for both the IT student and the practitioners. Speaking about sequence of courses in the educational plan, to our mind, economic studies should be arranged as follows. We should start with micro and macroeconomics. This provides the basics in economic knowledge. Then there should be risk management in conjunction with its mathematical approach – including game theory and probability theory. After completing those disciplines, management and marketing with the basics of sectoral and

regional Economics become relevant. After that, you can move on to mathematical models for modeling and forecasting. And finally – the basics of law. And it goes without saying that professional English should accompany the IT specialist at all stages.

By taking into account the ideas mentioned above, we can both improve the quality of the technologies used in science and Economics, and introduce positive changes to the market of educational services as well.

4. Conclusion

Information technologies can serve as a powerful tool for improving the financial and economic, organizational and managerial, production and technological and social efficiency of a business, but only if a particular decision is carefully thought out and well-balanced. Also, information technologies can improve the quality and reliability of business processes both in theory and practice. It is necessary for company managers to be able to foresee basic trends in development and application of IT technologies and to make prediction on the future situations, otherwise even the most expensive and powerful software product will not be competitive on the market, but will only bring wasteful time and money expenses. Given the above theses, the importance of having IT specialists not only technical, but also economic knowledge is obvious, especially if you want a significant career growth of a specialist. Summarizing all mentioned above, it is very important for an IT expert to possess not only technical knowledge, but also economic knowledge, especially if you want to reach significant career success.

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