Transformation in Russian IT Sector: Problem of Building Value System

USSR and so-called “socialist commonwealth” had an extensive computer industry, including hardware, software, peripherals and services in all platform classes from supercomputer to PC. Though this industry was based on intellectual property of IBM, DEC and other Western computer manufacturers, this industry contained original design solutions and also production and maintenance capacities. Still, all this industry was in major part abandoned almost immediately after the collapse of socialism in Russia in 1991 and replaced with imported hardware and software, in greater part PC-based[1]. This process was especially sharp in MIS[2] class of systems.

To understand this phenomenon, we compare this collapse with simultaneous competitive crash in US computer industry, caused by switch from mainframe to client/server platform. We show that despite technical closeness of computer platforms, they were quite different from the economic perspective. Different outcome in case of Russia was based on devaluation of complementary software. New management tasks in market conditions were not covered by formerly developed software.

Yet another problem needs to be addressed: why small newcomers outperformed established firms with thousands of programmers, analysts, managers and sophisticated software development technology? Our answer is: the established firms never attempted to create value for the buyer from usage of their systems. This fact resulted from core practices of IT systems usage under socialism, where the latter were looked at as a control tool for the upper level of management, not as a tool of adding value for the buyer[3]. So in early 1990-s the established firms did not compete in usual sense of this word and even did not know at all, how to compete. In such a competition success of newcomers was predetermined, regardless the superior resources and technical skills of the established firms.

1. The problem

The basic feature of IT industry market structure is persistence of platforms[4]. This means, that platforms usually persist for a long time, despite changes in market positions of particular firms. Complete abandonment of a platform is a very rare event due to heavy investment in hardware, software, maintenance, user and technical staff training and so on. Much of this investment is done by the buyer, and in major part becomes a sunk cost in case of switching from one platform to another. Persistence of platforms is also supported by strong positive feedback due to network externalities, discussed, for example, in [Shapiro, Varian, 1999]. These externalities are based on demand-side economies on scale. In case of computer industry the larger network formed around a platform presents more value to the buyer due to larger amount of available software, greater variety of peripherals and greater ease of information exchange among network users[5].

These economic conditions limit changes in market share of different platforms. As it is shown in [Bresnahan, Greenstein, 1997], new platforms initially serve new groups of buyers in a

[1] This was true for 1991-93. Later IT in Russia rapidly moved towards client/server solutions including high-end ERP systems
[2] Management Information Systems
[3] “Adding value” here is used in broader sense, than usual: under socialism enterprises are not aimed on value creation. Still we consider added value in this case as cost reduction, increase in information quality for decision-makers and so on.
[4] See, for example, [Bresnahan, Greenstein 1997] for general framework and [Sutton 1991] for the detailed analysis
[5] See [Shapiro, Varian, 1999, pp. 173-225] for network externalities discussion, [Bresnahan, Greenstein, 1997] for incorporating network externalities in market-mediated technological change framework.

new customer segment, thus avoiding competition with the established platforms. Successful newcomer platforms expand their networks for more and more segments, where they can compete with established platforms[6].

The only case of radical platform shift until now was switching from mainframe to client/server platform[7]. Bresnahan and Greenstein show that this shift was based on a complexity of platforms which eventually outgrew ability of any single firm to control a platform as a whole. This shift had the following features:

1. Control over new platform was split across different firms, controlling different components of the platform[8].
2. Existing mainframe software was successfully moved to new platform[9].
3. IBM switched to enterprise-wide servers, preserving architectural and software compatibility with former IBM mainframe platform[10].

Now let us turn to crisis in Russian IT. We will discuss it in more details in the next section, here only its key features will be outlined:

1. A platform, comparable to Russian mainframes, was neither developed, nor imported[11].
2. The production of mainframes stopped completely in 1995[12], no comparable import emerged[13].
3. Existing mainframe software was in major part abandoned, excluding specialised niches[14].
4. All former industry leaders lost their market; in IT industry currently dominate firms, established in 1991 or later[15].

To summarise, Russian IT crisis demonstrated not moving mainframe software to a new platform, but dramatic decrease in overall mainframe software demand, so to understand transformation in Russian IT, we should explain this demand decline.

2. USSR IT industry transformation: some key facts

To understand the depth of transformation crisis in Russian IT, we should first understand the scale of IT industry in the former USSR.

In terms of quantities, Soviet computer industry was comparable with one in European countries. For example, in early 1970-s total number of installed computers in USSR estimated as 6000 units[16]. At the same period of time in UK 14400 computers were installed, but at least in 60-s 50% and more among them were produced by US firms[17].

In 1970-s USSR computer industry concentrated its efforts on two platforms, ES EVM and SM EVM[18], illegal clones of IBM-360/370 and DEC PDP/VAX respectively[19]. Together

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6 See [Bresnahan, Greenstein, 1997] for examples of such entry and expansion

7 See [Bresnahan, Greenstein, 1997] for general discussion, [Vaskevitch, 1993] for more technical details on the client/server platform

8 See [Bresnahan, Greenstein, 1997]

9 See [Vaskevitch, 1993] for different technologies of software migration

10 The first generation of these servers was announced in 1990 as IBM S/390 – see, for example, IBM ESA/390 guide http://publib.boulder.ibm.com/cgi-bin/bookmgr/BOOKS/DZ9AR006/1.1?DT=19990630131355

11 See next section for argument

12 See [Пржиялковский]

13 See [Пржиялковский] – according to his data, approximately 1600 IBM mainframes were imported within 10 years after 1990, compared with former USSR production approximately 16000 units in 15 years 1975-1990 and more than 10000 in 10 years 1980-1990

14 See [Кузьминский, 2006]

15 Top-20 Russian IT companies since 2002 till now are established in 1991 or later – see Рейтинг крупнейших ИТ-компаний, 2002, РА-эксперт, 2003, http://www.raexpert.ru/ratings/it/2002/

16 See [Гладких, 2005, p.103]

17 See [Flamm, 1988, p.135, tables 5-1, 5-2]

18 Transliteration of Russian «ЕС ЭВМ», that is Unified Series of Electronic Calculating Machines and «СМ ЭВМ», that is System of Small Electronic Calculating Machines

with IBM and DEC hardware peripherals were cloned as well. Large amounts of software were also cloned and localised. Software compatibility allowed translation and extensive usage of foreign technical literature, which, in turn, allowed building education and training infrastructure (see [Гладких, 2005], p.103. Total amount of computers built within this clone-making program, achieved 35000 (18 000 SM EVM[20] and almost 17 000 ES EVM[21]).

The main problem, resulting from this program, concerned software market, as major part of software was copied illegally, paying no attention to producers' property rights. Inadequate semiconductor components were another problem of the program – Soviet semiconductor industry never reached quality level of US standards. As a result, both ES EVM and SM EVM suffered serious problems with performance, availability and reliability of overall systems in comparison with their US prototypes. Finally, the clone-making program resulted in vulnerability of internal Soviet teams of hardware and software developers, many of them decayed in 1975-1985.

Computers were used in economic activities in different organisation forms. Most common was so-called "ASU"[22], which automated activities of an enterprise or a government body. In 1971-1985 8 248 ASU were built, including 2023 enterprise ASU and 1744 government body ASU. 4481 automatic process control systems were also included in overall figure[23]. Another organisational form was a collective computer centre, providing computational services to remote users. Within OGAS[24] program more than 2000 collective computer centres were planned[25]. Actually built was only a small fraction of this amount, since Soviet phone lines did not allow data transfer rate higher than 1200-2400 bps, which was too low for an effective computing. As a result, users had to visit collective computational centre physically, presenting data on punch cards, magnetic tapes, later – on magnetic disks. Under these circumstances, the project was cancelled.[26]

After 1990 production of ES EVM suffered sharp decline. Total production of ES EVM after 1991 is estimated as 300-500 units, it was completely stopped in 1998[27]. Data on SM EVM are not available to the author, according to expert opinions, their production stopped in 1993[28]. SoyuzEVMkomplekt, ES EVM technical maintenance organisation, stopped its work approximately in 1997[29]. Since that time maintenance of ES EVM also stopped. One should note that production of all models, except one (production amount – 20 units) stopped in 1991-1995, before maintenance from SoyuzEVMkomplekt was stopped. Finally in 1999 approximately 5000 ES EVM were still in use ([Пржиялковский]).

[Пржиялковский] estimates import of IBM mainframes, direct ES EVM competitors, as 1500 second-hand IBM 4381[30] and somewhat 100 IBM ES/9000 (the early version of IBM

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[19] Some Russian authors, for example [Филинов], argue that both ES EVM and SM EVM were not clones, but plug-compatible computers
[20] See [Егоров, 2002]
[21] See [Пржиялковский]
[22] Transliteration of Russian «АСУ», that is Automated Control System
[23] See [Народное хозяйство 1985, p.77]
[24] Transliteration of Russian «ОГАС», that is State-Wide Automated System.
[25] See [Глушков et al., 1973]
[26] See [Гладких, 1995, pp. 334-335]
[27] Estimated by the author using Virtual Computer Museum data on particular ES EVM models (http://www.computer-museum.ru/histussr/1.htm). In 1998 was stopped the production of ES-1220, total production – 20 units, see http://www.computer-museum.ru/histussr/es1220.htm . Production of other models stopped in 1995 or earlier
[28] See, for example, http://www.computer-museum.ru/histussr/sm1800.htm
[29] This date is not available in known literature. In CV, found in internet, the author found 1997 as end date of applicant's work in SoyuzEVMkomplekt
[30] According to [Bresnahan, Greenstein, 1997], [Flamm, 1988], IBM 4300 family directly competed with DEC VAX family, so IBM 4381 compete both with ES EVM and SM EVM

S/390[31]). These figures show that, on the one hand, import is comparable with domestic production (approximately 3 to 1 in favour of import), on the other – Russian mainframe market in 1990-2000 reduced to approximately 2000 units compared with approximately 10000 in previous ten years[32]. In other words, in overall production decline demand shift contribution exceeds several times influence of import, and this demand shift happened before technical maintenance was stopped. So let us turn to the demand analysis.

3. IT usage in USSR and IT demand decline in early 90-s

According to ITIL v.3.0, de facto standard in IT management, "IT is a category of services, utilized by business. These services are typically IT applications and infrastructure that are packaged and offered as services by internal IT or external service provider"[33]. Under this approach, demand for IT services, that is information services, provided with the aid of IT, determines demand for IT infrastructure and applications. In our analysis of IT demand in Russia we should follow this service framework.

We once again start with US and Europe case analysis to understand the specific features of IT usage in USSR.

Early IT business usage: some US and Europe cases

First computers, like British Colossus or American ENIAC, were used as powerful calculators for military and scientific purposes. Initial usage of computers in business was similar, that is primarily for engineering calculations[34]. In 1960-s computer was valued as data processing tool as well. Banking industry case can be found in [Gamble, 1989], chapter "The bank in 1960-s". Federal Reserve Bank of Atlanta in early 60-s used computers together with MICR[35] devices to process checks, obtaining more than 40 times productivity increase.

At the same time the first computerised air reservation system, well-known SABRE[36] took over all ticket booking functions[37] and became the largest private data processing system[38]. Its functions were also relatively simple: it was an ad hoc inventory database[39]. Years later American Hospital Supply (now – Baxter) installed it's ASAP order entry system. By means of this system hospitals, served by AHS, could send orders for supplies remotely. German firm SAP, now leading ERP systems manufacturer, started its work in 1972 with two relatively simple systems: accounting system RF and material management system RM.

In all the cases examined we can see one and the same scheme. The most successful and widely used products emerged as ad hoc software with limited functionality, aimed at solving vitally important and clearly stated task. The affect of system implementation was also clear and well observed. The success of initial implementation led to new projects, either coverig new tasks or broadening functionality of existing systems. For example, Federal Reserve Bank of Atlanta in 1968-72 implemented automated clearinghouse as a brand new functionality[40] and American Airlines in 1976 allowed travel agencies to use SABRE system via remote terminals

[31] See IBM internet archives http://www-03.ibm.com/ibm/history/exhibits/mainframe/mainframe_FS9000.html
[32] Though estimates of Russian ES EVM production is nothing but rough-cut, 5 times decline is robust enough against possible inaccuracies
[33] See [ITIL, 2007, p.20]
[34] See IBM archive record on IBM 701 applications: http://www-03.ibm.com/ibm/history/exhibits/701/701_first.html
[35] Magnetic Ink Character Recognition
[36] Semi-Automated Business Research Environment
[37] See [Flamm, 1988, p.89]
[38] See Sabre web archive record http://www.sabretravelnetwork.com/about/history.htm#1960
[39] See [Ciborra, 2002, pp.40-41]
[40] See [Gamble, 1989, chapter "Technological pioneer"]

(130 locations by the end of the year)[41]. So a sophisticated system was developed within a number of relatively small, well controlled steps. Obviously, not every project was well controlled, still the above listed cases existed, and continued in 1970-s, when large top-down IT projects emerged. Later this step by step approach was carefully examined as a best practice (for example, [Ciborra, 2002]. As we will see, this situation differed dramatically from IT implementation in socialist economy.

IT implementation in the USSR

In USSR IT implementation started as a government project within ASU and OGAS framework (see section 2). In brief, the program goal was to create a state-wide network of powerful computing centres (OGAS), sharing data processing and data themselves across all possible users from top to bottom with state-wide government bodies as a top level and enterprises as a bottom one[42]. As an intermediate level a network of regional calculation centres and message switching centres[43] was projected. The main function of OGAS was support of government economic planning: processing plan variants, optimising location of new enterprises, including human resources in overall system of plan development, etc.[44] Calculation centres of government bodies should be made subordinate to OGAS.

V.Glushkov, at that time chief architect of OGAS program, provided a detailed “business case”[45], describing information duplication in contemporary systems and its possible reduction in OGAS ([Глушков et al., 1973], pp.19-21.). Technical description, detailed up to specification of data transmission rates, data encryption and programming languages, was also developed. The weak point of the project consisted in ignoring the institutional aspects of management and control systems in former USSR, which will be discussed in the next section.

The realisation of the OGAS program met serious design and implementation problems. In accordance with OGAS structure we will examine 3 cases: state-wide OGAS as a whole, regional calculation centre in Tomsk region and enterprise ASU “Kuntsevo”.

In [Глушков, 1975] V.Glushkov analyses first problems of OGAS realisation. It turned out, that OGAS information database would take 10-15 years to create. As government control system would surely change within such a long period of time, the system had to be flexible enough to absorb these changes ([Глушков, 1975], p.8). In [Мясников, 1979] OGAS program was revised with no sign of serious progress, OGAS status is described similar to earlier paper of V.Glushkov. Relative progress is achieved in two spheres: first, building technical infrastructure of calculation centres and data transfer ([Мясников, 1979], pp.13-17), second, automatic process control systems and CAD systems ([Мясников, 1979], pp.24-27). Overall results of OGAS program, at least in part of “business” applications, were summarised in [Поспелов et al., 1998]: “Since late 60-s ones started active implementation of cybernetic models into practical control systems on different levels. Government actively supported this initiative by means of extensive financing state-wide programs of building automated control systems for enterprises, industries, regions and whole state as well. Data transfer and processing networks development programs, projected to cover the whole country, were linked with global ideological program of building the Communist society. These Napoleonic plans were not supported by adequate technical basis and were doomed to failure” (p.33).

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[41] See Sabre web archive record: http://www.sabretravelnetwork.com/about/history.htm

[42] See [Глушков et al., 1973, pp.11-13]

[43] Message switching technology was developed in ARPA and eventually evolved in currently used packet switching and frame relay technologies, see, for example, [Гладких, 1995], pp.338-342

[44] See [Глушков et al., 1973, p.8]

[45] Economic activities in the former USSR were quite different from business in a usual sense, so we use term “business case” to designate economic analysis of the project

The case of building regional ASU project is described in details in [Перегудов et al., 1977]. In this case one can see problems of goal-setting for such a project in planned economy. As a goal of regional economy "effective use of regional capacities to meet socio-economic demands of Soviet society on the basis of combining regional and industry-wide control principles" (p. 66). Under these goal-setting the goal of ASU project was very difficult to formulate and it was not formulated at all. Instead a general approach was formulated: "framework, oriented on control functions automation based on control methods and models, combining regional and industry-wide approach" (p.76). This approach started with region goal tree and function tree and resulted in a very complicated structure even on the drafting stage. In 1970-s limited functional scope was put in production. On this stage project suffered serious problems due to insufficient data transfer rate and was cancelled ([Гладких, 1995], pp.334-335).

Finally, we will discuss a case of enterprise level ASU "Kuntsevo", described in [Никаноров, 1999] as a typical one. The project was launched in 1966 with the goal to develop detailed project of future system within 3 years. The system project was developed for a big enterprise, specialised in defence electronics with highly diversified and rapidly changing output. ASU was to cover all the managerial functions – planning, material management, production and financial calculations and accounting[46]. The project (150 volumes of documentation) was ready in due course in 1969 and was to be implemented in all the enterprises of military electronic industry. It turned out that project could not be implemented "as is" at any enterprise, only basic framework portable. In next three years (1969-72) the attempt to implement ASU was carried out at one enterprise, were only certain subsystems could be put at work. As a result project leader was fired in 1972 and the whole project was cancelled in 1974. This was the first and the last attempt to cover all the function of planned enterprise with one system. Fragmented systems were implemented at different Soviet enterprises (see overall figures in section 2).

Now we turn to summary of ASU efforts in USSR. These efforts started in late 1960-s in order to create state-wide information system, managing all information flows in Soviet economy. This resulted in more or less coordinated attempts to create a centralised ASU, controlling the enterprise, region or national economy as a whole. This ambitious task was unsolvable for both insufficient IT infrastructure and absent organisation management skills. In the next subsection we will also discuss institutional factors of the ASU program failure. Still moderate progress could be observed in three different spheres:

1. Building IT infrastructure on enterprise, regional and industry levels.
2. Implementation of IT systems for process control, design and engineering calculations. The role of this ASU segment grew rapidly, achieving approximately ? of all ASU built in 1980 - 85 ([Народное хозяйство, 1985], p.77).
3. Local automation of different control functions of Soviet enterprise and government body (see examples in [Никаноров, 1999]).

As we will argue in the next subsection, this contradiction between ambitious goals and moderate results is based in institutional problems of centrally planned economy.

IT problems and institutions of centrally planned economy

As Janos Kornai showed in ([Корнаи, 1990]), shortage, hard resource constraints and soft budget constraints are inevitable for centrally planned economy. If enterprise[47] suffers lack of any resource it adjusts either via search or via replacement with the other resource[48]. The latter usually affects product quality, so the consumer (household or another enterprise) may refuse to take such a product. Consumer decision to take a product or refuse from it depends on the

[46] In the planned economy marketing and sales functions on the enterprise level are unnecessary.
[47] From now on in this subsection we mean enterprise in a centrally planned economy.
[48] Generally an enterprise had other options as well, but we will limit discussion with those mentioned by Kornai. This does not affect the results obtained.

importance and shortage of a product and replacement options. So actual output is uncertain and depends both on resource supply and consumer decisions. The higher is planned output, the more often resource shortage occurs, the more difficult is settlement of this shortage. So the higher is the planned output, the less certain is it achievement.

For these conditions Kornai depicts central planning as follows. Planning body knows the lower limit, which will be easily achieved, but hardly meets goals of the body itself and upper limit, meeting the goals of the planning body, but highly uncertain because of heavy resource shortage. According to Kornai, planning body sets planned output somewhere between the limits described. This plan is concerned as so-called “normal plan strain” ([Корнаи, 1990], pp.76-79). Kornai considers this normal plan strain as historical value, fixed in the implicit contract (p.79). The process of achieving normal plan strain is called “plan bargaining”, as both limits and final value are set in a dialog between a planning body and enterprise head[49].

One should note that here we see a typical case of a principal-agent problem with an appropriate information asymmetry. Under conditions of prescriptive planning this situation leaves much room for opportunism (in O.Williamson sense) both for planning body and enterprise head. Under uncertainty of production frontier and information asymmetry, the plan objectives can be achieved only if both planning body and enterprise head join their efforts, so they are to some extent interdependent partners. But if the production frontier is certain, or, at least, the planning body knows with the same degree of certainty as an enterprise head, the latter becomes a resource used to achieve plan objectives. So the less is information asymmetry between planning body and enterprise head, the more power obtains the former over the latter[50].

Another feature of central planning mechanism, influencing ASU usage, was planning method “achieved level plus”[51]. According to this method output plan for the next period is calculated as a highest output, achieved in any previous period plus some increase, usually small percentage of the previous maximum. This method complies with the production frontier uncertainty (new compromise is based on previous one, avoiding serious changes and associated risks), but undermines any serious increase in productivity, for example, resulting from IT usage. If in a period t an enterprise achieves output growth and cost reduction, than planning body will set higher objectives in the period t+1.

Now let us examine OGAS/ASU project using the above stated framework. The core of any organisation-wide (enterprise-, industry-, region- or state-wide) information system is a common database used by all authorised members of the organisation. In case this database serves as data interchange medium within organisation, amount of the information available is determined by database design and user access rights, so nothing prevents upper level from making the lower level as transparent as possible, shifting balance of power within organisation. This was exactly the case of OGAS/ASU program, for example, in [Глушков et al., 1973] V.Glushkov clearly describes OGAS as a distributed database system, incorporating state-wide government bodies, regional authorities and enterprises. Unfortunately the institutional changes inspired by such technological advance were not considered while discussing an ASU/OGAS program so the decision-makers at all program levels were completely unaware of it. As a result, the authorities participating in the program regarded it as an opportunity to gain control over their subordinates and a threat of control from the senior control levels. Due to information

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[49] In [Прохоров 2006] one can see interesting example of such a bargain. I.Stalin, at that time leader of the USSR, demands the minister of oil industry to achieve 60 million tons oil output, three times higher than the current output of the USSR oil industry at that time. Luckily oil minister immediately recalled a number of problems, requiring additional resources and I.Stalin agreed to provide them. This case shows bargaining when according to general opinion planning was totally prescriptive.

[50] The similar argument is valid for any level of control in centrally planned economy, for example, enterprise head and department head or industry planning body and central planning body.

[51] See [Корнаи, 1990], p.80

asymmetry, the “defence side”, that is subordinate level was bound for success: implementation of any ASU depended heavily on their knowledge.

Under these conditions the distributed databases usage as means of management and control became impossible: all the control levels regarded such a system as a balance of power shift. As a result, the project either died in a swamp of endless agreements, adjustments and approvals or was sabotaged in the production phase. One of the typical examples of such sabotage is described in [Прохоров, 2006], pp. 219-220. On Lenelektronmash enterprise an electronic workflow system was implemented. By means of the system all the requests and claims were registered so control of their fulfilment was made possible. This system was sabotaged by all the managers of the enterprise who sent requests via mail, telephone, but not via the system. The enterprise director recognised this problem, so he punished and even fired those who avoided the workflow system. Finally a Communist party[52] meeting voted distrust to enterprise director ending this way the project as a whole.

Another problem of ASU implementation concerned economy of shortage. As we saw in [Корнаи, 1990], in centrally planned economy resource supply is insufficient and unpredictable. At the same time plan objectives cannot be met if an enterprise limits output to the amount, allowed by the most restrictive resource shortage. So an enterprise has to replace deficient resources ad hoc with possible loss in product quality or production efficiency. To make things worse, suppliers never meet time schedule of resource shipment and the date, time and size of any resource lot are also unpredictable. As a result, resource input, technology alternatives, production frontier and production schedule are highly uncertain so output or production schedule cannot be optimized in any formal sense.

On the contrary, process control systems and other specialised IT systems, not affecting balance of power, control and information were successfully implemented and operated. Among those success stories airline reservation system Sirena-2[53] and mine transport dispatching system Karat can be mentioned. Rapid growth of process control systems and relative decline of ASU show this trend as well.

ASU status in early 80-s

After failure of system approach at all levels, ASU scope was limited to production planning support. For example, in [Сытник, 1977, p.11] the following ASU functions are listed:

- Output planning,
- Production schedule planning and control,
- Supply planning and control,
- Accounting.

These functions were in major part performed by IT staff, so specification and comparison of different variants was almost inaccessible. With these features IT services performed by ASU were limited to the most stable and certain functions, like payroll calculation and accounting. Situation with process control systems was quite different. Though they also suffered from instability of production process, its effect was less, at least if the system could be adjusted to the replacements made.

To finalise our review of USSR IT implementation we should understand Soviet methods of estimating economic effect of IT implementation. The fact is that reports of ASU program leaders estimate economic effect of different ASU in millions of roubles per year (for the moment official US dollar rate was 1 USD = 0,66 rouble)[54]. To analyse feasibility of these

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[52] A dominative party in the USSR, actually the system of control parallel to a government one
[53] See [Жимерин, Мясников, 1977], p.10
[54] For example, effect of ASU-pribor (in appliances industry) is estimated as 22 million rubles per year, effect of ASU Gossnab (shipment and delivery) as 40 million rubles ([Жимерин, Мясников, 1977] p.10-11)

results we examined the methods of economic effect estimation (see [Андрианов, 1977]). Typically the economic effect of ASU implementation was calculated as change in profit in comparison with previous period, multiplied by the ASU share of this change. The author examines in detail factors, influencing the profit (output increase[55], cost reduction, penalties reduction, etc.), but provides no mechanism of ASU share determination. In this case the ASU share could be assigned any value between 0 and 1, and the overall effect is de facto limited with "achieved level plus" rule. The only exception concerned automated process control systems. Such a system usually affected only one process, changing directly its inputs and outputs, so these changes could be measured much more accurately.

As a result of previous discussion, we can outline the following features of ASU usage in centrally planned economy:

1. Information transparency shifted balance of power and control in favour of upper control levels, so lower levels avoided it by any possible means. This severely limited ASU usage outside well formalised applications, like payroll calculations.
2. "Achieved level plus" principle stimulated splitting ASU effect (in case it emerged in practice).
3. Typical models of ASU effect estimation told nothing on determining ASU fraction in output growth, cost reduction, etc. So such models allowed manipulation of effect amount over wide range.
4. Automated process control systems could improve performance indicators of an enterprise without any shift in the balance of power and control, and with the course of time become the major IT application (near ? of overall ASU implementation in 1980-85).

4. From balance of control to value creation: failed incumbents and successful newcomers[56]

Now we can return to the problem of IT demand reduction in early 1990-s. To begin with, value of IT services from customer perspective depends on two parameters: utility or fitness for purpose and warranty or fitness for use ([ITIL, 2007], p.35). Let us start with utility.

The goal of a typical Russian enterprise at early 1990-s can be expressed in one word: survival. GDP declined 5% in 1991, 14,5% in 1992, 8,7% in 1993 and 12,6% in 1994, totally 35% in four years[57]. Inflation in 1992 exceeded 1000% and did not lower below 100% until 1996[58]. Moreover, after Gaidar reforms in 1992, problem of resource shortage lost its priority in favour of budget constraint. As a side effect of price shock, arrears grew rapidly (for example, in 1994 they grew 5,5 times to the previous year[59]). Uncertainty of enterprise environment even grew, though uncertainty of resource supply was replaced with uncertainty of arrears.

These events dramatically changed tasks of enterprise management. First, operational management had to switch from obtaining necessary resources to finding solvent customers and cash collection. Second, new holding companies, formed within privatization process, had to consolidate their material and financial flows. Third, commercial banking, a new sector in Russian economy, had to manage loans, deposits, payments, clearing and other necessary activities. Fourth, formal rules and routines of accounting, commercial document exchange, wage calculation and so on dramatically changed within 1-2 years, and these changes continued. To make things worse, Russian economy suffered severe shortage of established management routines and practices as well as people familiar with these practices.

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[55] In centrally planned economy price-setting is also centralized, so spontaneous price drop in case of output increase is impossible

[56] In this section we deal only with business software, leaving automated process control system aside

[57] See [Россия 1997], p.10

[58] See [Россия 1997], p.12

[59] See [Россия 1997], p.208

Rapid changes, listed above, obviously changed radically IT services, required for Russian enterprise. First of all, Russian managers required software to control financial state of their enterprises and perform standard accounting procedures. Then, emerging commercial banks required software, specialized for their purposes. As privatization went on, new holdings expressed demand for corporate-wide financial management and consolidation. Other requirements in early 90-s were put aside due to shortage of adequate procedures.

To provide value for the most customers, this software required two features: low price and quick response to regulatory changes. As procedures and routines were not standardized, data exchange with other functions like marketing, production, procurement and so on could not be organized. As a result, distributed workflow with common database became in most cases unnecessary. If accounting department was big, customer demanded ability to share data across accountants. So technical requirements reduced to standalone workplace or simple network environment on a file-server basis[60].

Financial situation in banks holdings at that time was relatively good, so they paid less attention to costs, but they demanded much more reliability and networking capabilities instead. Still these requirements were moderate and simple file-server network environment, like Novell Netware, could meet them easily. From this point of view holdings were an exceptional case: they demanded data exchange too extensive for a file-server environment. Demand for rapid response to regulatory activities was as high as in previous case.

The problem was that none of these tasks was performed in ASU. ASU developers focused on production planning, though they did not take into consideration supply shortage and uncertainty. Formal procedures and documents of accounting, payroll and so on, used in former USSR were abandoned, so new software was to be developed from the scratch. Functions, necessary for market environment, like financial accounting, cost accounting and cash flow management were brand new to ASU developers. To make things worse, ASU developers got used to a top-down project development methodology, which was enormously complicated and time-consuming in case of development a brand new application. For example, industry standard of ASU development required 28 man-years for such a development[61].

In this situation overall value of existing ASU was negative because of zero customer value and substantial support costs. Existing staff could not develop necessary software in reasonable time and budget. So the crucial factor of platform stability, that is high switching costs, was eliminated, leaving business software market to new entrants.

New entrants immediately arouse: a crowd of small firms, developing PC-based software, in major part accounting one. So first firms of new wave[62] aimed at that market. Banking software became promising sector, attracting developers of business software with networking capabilities[63]. Interestingly, there is hardly one example of a firm, selling software in both segments. Neither software required sophisticated IT infrastructure: development of an industrial-strength solutions is a costly and time-consuming project and resulting product is difficult to change. Finally, integration of enterprise business-processes was useless as processes themselves did not exist. So an industrial-strength product had no value on the contemporary market[64]. As a result existing mainframe-based infrastructure was also devalued and often abandoned, new software developers relied on PC and file-server networking infrastructure.

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[60] File-server systems sends users whole data files from the server. On the contrary, client/server system send not a whole data file but only necessary data records. As a result client/server system has far more capacity to process extensive data exchange traffic and large corporate-wide databases

[61] See industry standards database on the web: http://www.internet-law.ru/law/gosts/normatives.htm

[62] «Хакерс дизайн» (1990), «корпорация Парус» (1990), «Инфин» (1990) and others

[63] «R-style» (1991), «Диасофт» (1991), «Програмбанк» (1989) and others

[64] So import business software was also difficult to sell, leaving aside localization problems and costs

Holdings, formed in course of privatization became the only sector relying on imported business software. Foreign software developers were for that time unbeatable in client/server solutions due to extensive investments in late 80-s (client/server) and 70-s – 80-s (mainframe). SAP AG showed the way in 1994, selling SAP R/2 to Surgutneftegaz oil company[65].

As we could see, in early 1990-s ES EVM business software was completely devalued due to rapid changes in business needs. This in turn devalued extensive IT infrastructure inherited from former USSR. Large segments of IT market turned into a greenfield, where no competitor had advantage of installed software. In this situation competitive advantage was in low costs and quick response to regulatory changes, exhibited by new entrants. This market shift devalued legacy mainframes as new software was simple enough to run on a standalone PC or in simple network environment.

5. Conclusions

Russian IT crisis has at least one unique feature. In early 1990-s at the peak of the crisis demand for industrial-strength IT reduced 5 times compared to the period of 1980-1990. Well known explanation of this phenomenon – shift from mainframe to client/server platform – does not work as legacy platforms were crowded out by PC-based platforms, not client/server ones.

Alternative explanation rests on the thesis of strict limits imposed on business computing by centrally planned economy. As a result Soviet enterprise relied on its IT solutions in management and control field only in small number of highly standardised application. In critical management sphere, production planning and management, IT solutions were of little value due to high degree of uncertainty and informal nature of decision-making.

This became deadly problem in 1990-s, when centrally planned economy was replaced with market one and rapid change in business requirements devalued installed base of business software. Under these circumstances new entrants relying on PC and simple networking infrastructure gained competitive advantages of low costs and quick response to customer needs. As a result mainframe-based business software devalued and mainframe infrastructure devalued as well.

1. References

[1] Bresnahan T.F., Greenstein S., Technological Competition and the Structure of Computer Industry, Stanford University Economics Department Working Paper 97-028, 1997

[2] Ciborra C., Labyrinths of Information, Oxford, England: Oxford University Press, 2002

[3] Flamm K., Creating the Computer: Government, Industry and High Technology, Washington, D.C.: The Brookings Institution, 1988

[4] Gamble R.H., A history of the Federal Reserve Bank of Atlanta, 1914-1989, Atlanta, Georgia: The Bank, 1989

[5] ITIL Version 3 Service Strategy, London, England: TSO, 2007

[6] Shapiro C., Varian H.V., Information Rules: a Strategic Guide to the Network Economy, Boston, Massachusetts: Harvard Business School Press, 1999

[7] Sutton J., Sunk costs and market structure, London, England: The MIT Press, 1991

[8] Vaskevitch D., Client/Server Strategies: a Survival Guide for Corporate Reengineers, San Mateo, California: IDG Books Worldwide, Inc, 1993

[9] Андрианов Д.П., Определение фактической эффективности автоматизированной системы управления предприятием и объединением, в сборнике «Алгоритмы и организация решения экономических задач», выпуск 2. Москва: Финансы и статистика, 1977

[65] See SAP AG press release on this implementation http://www.sap.com/cis/success/surgut.pdf

[10] Гладких Б.А., Информатика от абака до интернета. Введение в специальность. Томск: издательство НТЛ, 2005
[11] Глушков В.М., Жимерин Д.Г., Мясников В.А., Общегосударственная автоматизированная система (ОГАС), в сборнике «Алгоритмы и организация решения экономических задач», выпуск 2. Москва: Финансы и статистика, 1973
[12] Глушков В.М., Проблемы ОГАС на современном этапе, в сборнике «Алгоритмы и организация решения экономических задач», выпуск 6. Москва: Финансы и статистика, 1975
[13] Егоров Г.А., СМ ЭВМ. детальный обзор, Виртуальный компьютерный музей, http://www.computer-museum.ru/histussr/sm_evm2.php, 2002
[14] Жимерин Д.Г., Мясников В.А., Эффективное использование вычислительной техники в народном хозяйстве, в сборнике «Алгоритмы и организация решения экономических задач, выпуск 10, Москва: Финансы и статистика, 1977
[15] Корнаи Я., Дефицит, Москва: Наука, 1990
[16] Кузьминский М., Мэйнфрейм на ПК, Открытые системы, 24.02.2006
[17] Мясников В.А., Задачи и перспективы развития производства и использования вычислительной техники в народном хозяйстве страны, в сборнике «Алгоритмы и организация решения экономических задач», выпуск 13. Москва: Финансы и статистика, 1979
[18] Народное хозяйство СССР в 1985 году, статистический ежегодник, Москва: Финансы и статистика, 1986
[19] Никаноров С.П., АСУ: взгляд из 90-х в 60-е, Экономическая газета, 1999, №39-40.
[20] Перегудов Ф.И. (ed.), Системное проектирование АСУ хозяйством области, Москва: Финансы и статистика, 1977
[21] Поспелов Д.А., Фет Я.И. (compilers), Очерки по истории информатики в России, Новосибирск: Научно-издательский центр ОИГГМ СО РАН, 1998
[22] Пржиялковский В.В., Исторический обзор семейства ЕС ЭВМ. Виртуальный компьютерный музей http://www.computer-museum.ru/histussr/es_hist.htm
[23] Прохоров А.П., Русская модель управления, Москва: Эксмо, 2006
[24] Россия в цифрах. Краткий статистический сборник. Москва: Издательский центр Госкомстата России, 1997
[25] Сытник В.Ф., АСУП и оптимальное планирование, Киев: Вища школа, 1977
[26] Филинов Е.Н., Система малых ЭВМ (СМ ЭВМ). Виртуальный компьютерный музей http://www.computer-museum.ru/histussr/sm_evm.htm