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Quality management of automated information systems in IT projects

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Abstract. Quality and reliability of systems development and their further realisation, competent application of standards and software products are for IT-specialist standards and software products are for an IT-specialist to be an important factor in the successful implementation of a management solution. The article considers, on the example of use of quality standards of systems and use of methods and means of Microsoft Project software, the implementation of the study on the example of company engaged in the extraction and transportation of natural gas, in which, today, there is a large fleet of automobile and special equipment and departmental gas stations. Within the article the realisation of only one research task is considered: development of data processing algorithm at branches. The project successfully passed all the necessary tests, after which an act of acceptance of integrated systems into operation was drawn up.

1. Introduction

More and more mastering of the new for our country economic environment of reproduction, i.e. market relations dictates the need to continually improve the quality of using all possibilities, all achievements in the field of technology and organisation of production. The most complete and comprehensive quality assessment is provided when all the properties of the analyzed object are taken into account, manifested at all stages of its life cycle.

Today, development of information technologies bring new requirements to the training of IT-specialists of higher education, where not important value is given to an industry such as quality management and reliability of systems development. The base of theoretical and practical materials of students in the field of AIS development should be correlated with the competencies and practical skills for managing the reliability and quality of AIS. For example, the use of methods and models for evaluating AIS, standards for assessing the quality of software, testing to reduce risk and uncertainty in the implementation of AIS: ISO 9000_(standard to ensure the quality of project results);_ISO10006 (standard regulating quality of implementation of project management processes); ISO 8402 (quality management and quality assurance; ГОСТ 34.003-90; ISO 9001; ISO 9004; ISO 19011; ESA; Baldride Award;_IEC TC; IEEE 1074-1995; ANSI/IEEE 829-1983 (documentation during programs` testing); ANSI/IEEE 1008-1986 (testing of software modules and components of PS); ANSI/IEEE 983-1986 (software quality planning guide); ГОСТ Р_ИСО/МЭК 9294-93 and so on and so forth. Enterprises in the development and implementation of projects of varying complexity apply not only a number of standards, but also programs for project management, for example, Microsoft Project. Project quality management is a key aspect of project management along with cost and time management. Quality in the modern economy plays a strategic role in ensuring competitiveness. [1-3]

On the real example of a gas-producing enterprise in this article briefly (in connection of the limited

number of pages) consider the results of the research conducted by IT specialists with application of standards and software on quality management and reliability of AIS.

2. Problem statement

Gas producing enterprises in Russia are among the leaders in natural gas production and supply. According to experts, more than a third of the world's natural gas reserves are located on the territory of Russia, which guarantees future supplies to the world market and the further development of this industry. In this article the basic questions of automation of activity of some services of the gas-producing enterprise are considered, and quality management and reliability issues in systems development. For ease of presentation and on the basis of the law on commercial secrecy, describing the implementation of the task, we will use the fictitious name of the enterprise - «Enterprise X», as well as automated systems – «AIS_X1» and «AIS_X2».

«Enterprise X» - subsidiary, providing gas supplies to consumers in more than 13 regions of Russia, as well as supporting quality management systems, corresponding to the requirements of current versions of standards ISO 9001, GOST ISO 9001, etc. [4-7]

Today, the gas producing «Enterprise X» has its own fleet of automotive and special equipment, which, in turn, needs accounting and control of spare parts. A car park is a complex farm with a diverse production activity, which has an extensive fleet of special-purpose vehicles. For the automated accounting of the working activities of vehicle fleets, the specialized software system «AIS_ X1» is used, designed for automation of managerial and operational accounting in motor transport enterprises. The program «AIS_X1» is networked, and will allow you to work with a common database simultaneously from several workplaces: operator, dispatcher, accountant, manager.

Also, the gas production «Enterprises A» includes departmental filling stations, which have a comprehensive automated management system for petroleum products («AIS _X2»), which is designed to automate the process of receiving, dispensing and accounting of petroleum products, as well as monitoring the presence of petroleum products at departmental automobile filling stations.

On «Enterprise X» there are some business processes that do not perform effectively, namely, the tracking of travel sheets. With the development of the organization, respectively, increases the fleet of automotive equipment, which complicates the processes of issuing, accounting and closing of travel sheets. Having analyzed the existing "Places of productivity Fall" in the enterprise, the following shortcomings were highlighted: the calculation of residual petrol, oil and lubricants by way of travel lists, the re-taxing and the compilation of reports require a lot of labor and concentration; a large number of documents is maintained in paper form; it is impossible to provide operational reports to management within the time-frame; possible dispatcher errors when registering the amount of fuel filled by the driver (for example, without analyzing the driver's handwriting, registering other quantitative indicators, which may lead to inconsistency of reports and distortion of information) and others.[8]

As a result of the analysis of the «bottlenecks» at the gas producing «Enterprise A», a management decision on the integration of the existing systems «AIS1» and «AIS2» was proposed and accepted by the customer, and the following project tasks have been developed: a private technical task for the algorithm for transmitting data about gas stations and a private technical task for the algorithm of data processing at the branches, a private technical task for the algorithm data transfer on the facts of refuelling. [9]This article will discuss the implementation of only one task: the development of an algorithm of data processing at the branches. The solution will be implemented through the organization of data exchange between the systems «AIS_X1» and the «AIS_X2» through the SQL Server Task Scheduler (Job). Theoretical significance: possibility of application of developed algorithm for solving similar problems in other areas of national economy and practical-reduction of time processing of travel sheets and exception in them of discrepancies on refuelling with data of technical system «AIS_X2».

3. Implementing the algorithm

The algorithm is a finite set of rules that determines the sequence of operations for solving a specific set of problems and has five important features: finiteness, definiteness, input, output, effectiveness.

Algorithm description. The algorithm is designed to transfer the data about the facts of refuelling from the table X2 to table X3 in the system «AIS_X1» (table 1, 2). The algorithm must be implemented as a stored procedure that will be run using Job, With a frequency of not more than 10 minutes.

Table 1. Table X2 (information about the facts of refuelling).

Field name	Field type in DB	DB field name
Refueling ID, counter	type_id	ID
Link to the table field	type_id	AutomobID
Date of issue fuel	type_date	DateOut
Number of issued fuel	type_currency	Co_Int
Link to the table field	type_id	Benz_ID
Accreditation`s date (verification and acceptance of the refueling`s fact)	datetime	AcceptDate
Link to the table field	type_id	Pl_ID
Name of refueling	type_id	ZapravkaID
Date Modified	type_date	RC_Date
Type of record change	varchar(1)	Tp_Int

Table 2. Table X3 (Infomation about gas stations in waybills).

Field name	Field type in DB	DB field name
ID of gas station, counter	type_id_inc	X3Benz_ID
Number of filled fuel	type_currency	KolTopl
Link to the table field	type_id	Pl_ID
Link to the table field	type_id	Benz_ID
Link to the table field	type_id	ZapravkaID

When you start the procedure, open the transaction to the tables X2 . Then, in the temporary table, select all the records of the table X2, whose field value New equals NULL. Next, process the records of the temporary table that have the field value New equals NULL.

IF(1) value of field New records of the table X2 equals NULL
then
IF(2**)** ID of the processed record from the administration is ID of the record in branch
then
IF(3) Pl_ID of the processed record from the administration is Pl_ID from X2 in branch then
IF(4) field Pl_ID record from X2 administration is Pl_ID from X2 in branch, then
IF(5) field Co_Int record from the administration is field Co_Int record in branch
and/or
field Benz_ID record from the administration is равно Benz_ID record in branch then
have to move data from X2 to X3topl;
FUNCTION_1
(Begin)
In the temporary table for processing record (table X2) set value of field “New” = F;
If the last record of table X2, which value in field “New” == NULL then
- Write value “F” for the field New in the branch`s table X2, for records with similar ID records processed in a temporary table;

- clearing temporary table and change table;
- finalize transaction for the table X2;
- finalize the procedure:
Else go to next record's processing (Else(1))
(End)
Else(5) need to move data form X2 to the X3topl;
If(6) value of field is_ DoIT ot == «T» in table X3 with Pl_ID == Pl_ID from processing record then
Have to correct waybill for which changes were made on the facts of refueling**;**
If(7) during correction we get negative data about fuel residue then
field is_ DoIT ot = «F»
Taxation values haven`t to save;
Have to send alert about a lack of fuel to e-mail;
If the car is listed in the table X2 corresponds to the type of fuel filled from the table Automob, then sending alert about fuel``s moving to e-mail;
Function_1;
Else sending alert about fuel mismatch to the user e-mail;
Function_1;
Else(6)
Function_1;
Else(5) adding records in the changing table with ID, added Pl_ID record from administration and early contained Pl_ID record branch from which refueling will be transferred;
Moving data from X2 to X3topl, re-taxing on two waybill, on Pl_ID branch and Pl_ID administration.
If durind re-taxing got negative data then
Don`t save re-taxing values
Have to send alert about a lack of fuel to e-mail;
If(8) car listed in the table X2 corresponds to the type of fuel filled from the table Automob, then sending alert about fuel moving to the user's e-mail;
Function_1;
Else(8) sending alert about mismatch fuel's type to the user's e-mail;
Function_1;
Else(3)
Function_1;
If(9)Pl_ID processing records from administration == Pl_ID table X3 in branch, then moving data from X2 to X3topl;
If(10) value of filed is_ DoIT ot record == «T» in table X3with Pl_ID == Pl_ID from processing record, then re-taxing waybill
If during re-taxing we get negative results then
Have to send alert about a lack of fuel to e-mail;
If car listed in the table X2 corresponds to the type of fuel filled from the table Automob, then sending alert about fuel moving to the user's e-mail;
Function_1;
Else sending alert about mismatch fuel's type to the user's e-mail;
Function_1;
Else(10)
Function_1;
Else(9) sending alert to the administrator's e-mail;
Function_1;

Messages for E-mail alerts (message for user about progressing in fuel's moving)

In the waybill Number: <Number of waybill>, opening date: <Opening date>, closing date: <Closing date > The data on the amount of fuel issued has been changed and re-taxation has been made.

Message for user about mismatch fuel's type. In the waybill Number: <Number of waybill>, opening date: < Opening date >, closing date: <Closing date> the car was refueled with fuel, the brand of which does not correspond to the car indicated in the waybill. It was also re-taxing this waybill.

Message for user about lack of fuel. In the waybill Number: <Number of waybill>, opening date: <Opening date>, closing date: <Closing date> an error was detected during the taxation: « Actual flow, more fuel in the tank ». This waybill removed the sign "processed".

Rezult. Data in system «АИС_X1» moving from table X2 in table X3topl.

With the number of entries in table X2 more than three million and the availability of new entries for processing in the amount of three thousand, the algorithm should take no more than three minutes.

4. Develop a project schedule using Microsoft Project

To ensure complete quality control and reliability of the project, the research has developed: project initiation, project plan, shedule, resources, using tasks, using resources, risks and project costs, reporting and another.[10-11] Create a hierarchical work structure (ISR) to manage project deadlines. The chief administrator of the project appealed to the consulting service on the issue of creating a business plan. It is this structure of work that implies a more rational sequence and content of operations (table 3).

Table 3. Hierarchical structure of the project works.

№	Task name	Duration
1.	**- Development of an integration project**	**73,13 days**
2.	**- Pre-project examination**	**10,88 days**
3.	Project definition	1,08 days
4.	**- Planning**	**10,38 days**
5.	Project schedule plan	5 days
6.	Budget planning	5 days
7.	Risk planning	5 days
8.	**- Design**	**17,35 days**
9.	**- Integration Structure Design**	**7,8 days**
10.	Determining the specification of the systems used	1,08 days
11.	Infrastructure analysis	5 days
12.	Analysis of enterprise business processes	2 days
13.	Creating an integration scheme	1,39 days
14.	Integration Center Design	6 days
15.	Designing SQL data transfer procedures	11,5 days
16.	Content Design	6 days
17.	Designing new forms of data processing	0 days
18.	Analysis and Management	3,5 days
19.	**- Coordination with the customer**	**3, 88 days**
20.	Interview and approval with the customer	1,88 days
21.	Revision	2 days
22.	**- Coordination with management**	**6,88 days**
23.	Transfer of project documentation	2 days
24.	Coordination with the programming department	2,38 days
25.	**- Transfer of project documentation**	**3,88 days**
26.	Parsing and archiving documentation	1 days
27.	Conclusion of an agreement	0 days
28.	Waiver	3 days
29.	**+ Project team meeting**	**63,63 days**

After presentation of the hierarchical structure of works it is necessary to prescribe structure and type of resources for project realization (table 4). After we have defined the necessary resources, we need to write the employment of each resource in a particular task. The employment time of each resource was assigned in accordance with the labor contract, job description, staffs chedule.

Table 4. Resource sheet.

№	Resource name	Type of	Group	Maximum unit	Experience is	Standard rate	Overtime rate	Accrual	Base calendar
1.	Ivanov	Labor	Administrator	100%		$1000,00 month	$1000,00 month	Proportional	Standard
2.	Petrov	Labor	Economist	100%		$1000,00 month	$1000,00 month	Proportional	Standard
3.	Sidorov	Labor	User	100%		$1200,00 month	$1200,00 month	Proportional	External testing department
4.	Galkina	Labor	User	100%		$500,00 month	$500,00 month	Proportional	External testing department
5.	Uvarov	Labor	User	100%		$1000,00 month	$1000,00 month	Proportional	External testing department
6.	Vasin	Labor	Head	100%		$800,00 month	$800,00 month	Proportional	Standard
7.	Kazlov	Labor	Web-programmer	100%		$800,00 month	$800,00 month	Proportional	Standard
8.	Baranov	Labor	Web-programmer	100%		$500,00 month	$500,00 month	Proportional	Standard
9.	Hurricanes	Labor	Web-designer	100%		$500,00 month	$500,00 month	Proportional	Standard
10.	Eremin	Labor	Web-designer	100%		$0,00 month	$0,00 month	at the beginning	Standard
11.	Zhukov	Labor	Analyst	100%		$500,00 month	$500,00 month	Proportional	Standard
12.	Sergeeva	Labor	Tester	100%		$600,00 month	$600,00 month	Proportional	External testing department
13.	Ulendeeva	Labor	Tester	100%		$750,00 month	$750,00 month	Proportional	External testing department
14.	Limonov	Labor	Tester	100%		$800,00 month	$800,00 month	Proportional	External testing department
15.	Burkov	Labor	Content Manager	100%		$500,00 month	$500,00 month	Proportional	Standard
16.	Semenov	Labor	Content Manager	100%		$750,00 month	$750,00 month	Proportional	Standard
17.	Borisov	Labor	Economist	100%		$500,00 month	$500,00 month	Proportional	Standard
18.	Tararuhin	Labor	System Administrat	100%		$550,00 month	$550,00 month	Proportional	Standard
19.	Terekhov	Labor	Corrector	100%		$400,00 month	$400,00 month	Proportional	Standard
20.	Specialized Software	Material	Material	100%		$1500		Proportional	

Time and cost. This is an important part of the planned activities. How concise the plan depends on the speed of getting the result from the planned actions. The time required to perform the work was also proposed by the consulting firm for the preparation of the business plan.[12-14] Project execution time is shown in Figure 1.

Also an important factor of the project progress is its cost. During project planning, resources are set to their cost. The cost of the work was based on the average market prices of resources, as well as the rates of hourly and overtime work from the employment contract.

Project risks. The implementation of the system integration project also has a number of risks. One of these risks is not to meet the deadlines. The task for the project manager in analyzing the risks of the schedule is to reduce the likelihood of disruption of work.

To do this, we analyze the duration of tasks for very short durations. First, set up and run the filter according to the necessary condition minimized. After applying the filter you can see that there are not such tasks, so this project risk is minimized.

The next type of risk is the risks associated with financing the project. As the customer finances the project, this risk is minimized. Also in the implementation of the project there is such a kind of risks as the competence of the workers involved in the implementation of the project. This type of risk is also minimized as we carefully select the personnel to participate in the project.

Project execution. When the project is completed, it starts to run. In this regard, progress data is entered. Depending on the degree of accuracy, you can enter this data in different ways. Types of actual data input (descending accuracy): entering timephased resource data; entering timephased task data; Enter actual or remaining work Enter the percentage of completion.[15-17]

The actual information of this project was introduced in a combined way, that is, using several types of input (table 5). Here we see that all the tasks were executed in time, respectively, the project manager does not need to take any rational decision on how to accomplish unfinished tasks.

Table 5. Actual cost.

№	Task name	% completion	Actual costs	Actual work
1.	**- Development of an integration project**	92%	5982,62$	995,55ч
2.	**- Pre-project examination**	100%	1920,59$	347,2ч
3.	Project definition	100%	142,50$	21 ч
4.	**- Planning**	100%	1778,09$	326,2ч
5.	Project schedule plan	100%	408,44$	48,12 ч
6.	Budget planning	100%	1277,61$	263,35 ч
7.	Risk planning	100%	92,04$	14,73 ч
8.	**- Design**	96%	3028,41$	535,65 ч
9.	**- Integration Structure Design**	100%	701,15$	191,38 ч
10.	Determining the specification of the systems used	100%	77,19$	16,38 ч
11.	Infrastructure analysis	100%	320,83$	88 ч
12.	Analysis of enterprise business processes	100%	140,63$	35 ч
13.	Creating content delivery plan	100%	162,50$	52 ч
14.	Integration Center Design	100%	1178,13$	41 ч
15.	Designing SQL data transfer procedures	100%	819$$	214,32 ч
16.	Content Design	100%	107,33$	29,23 ч
17.	Design completed	100%	0,00$	0 ч
18.	Development of technical specifications	92%	221,97$	59,73 ч
19.	**Revision**	48%	205,03$	24,72 ч
20.	**+ Coordination with the customer**	63%	828,59$	87,98 ч
21.	**+ Project team meeting**	100%	0,00$	0 ч

Monitoring and control of the project. The following are tables with estimates of the earned

value method (table 6).

Table 6. Earned volume.

№	Task name	BSZR ($)	BSVR ($)	FSVR ($)	OKP ($)	OPS ($)	POPZ ($)	OPZ ($)
1.	**- Development of an integration project**	10524,44	4991,88	5144,48	-5532,55	-152,60	12441,02	-369,03
2.	**- Pre-project examination**	1494,38	1494,38	1920,59	0	-422,21	1920,59	-422,21
3.	Project definition	140	140	142,50	0	-2,50	142,50	-2,50
4.	**- Planning**	1358,38	1358,38	1778,09	0	-419,71	1778,09	-419,71
5.	Project schedule plan	776,50	776,50	408,44	0	368,07	408,44	368,07
6.	Budget planning	253,13	253,13	1277,61	0	-1024,5	1277,61	-1024,5
7.	Risk planning	328,75	328,75	92,04	0	236,71	92,04	236,71
8.	**- Design**	2814,21	2763,19	3018,86	-51,02	-255,67	3074,61	-260,39
9.	**- Integration Structure Design**	399,61	399,61	701,15	0	-301,54	701,15	-301,54
10.	Determining the specification of the systems used	77,97	77,97	77,19	0	0,78	77,19	0,78
11.	Infrastructure analysis	156,02	156,02	320,83	0	-164,82	320,83	-164,82
12.	Analysis of enterprise business processes	87,50	87,50	140,63	0	-53,13	140,63	-53,13
13.	Creating content delivery plan	78,13	78,13	162,50	0	-84,38	162,50	-84,38
14.	Integration Center Design	1400	1400	1178,13	0	221,87	1178,13	221,87
15.	Designing SQL data transfer procedures	494,49	450,89	819,84	-41,60	-368.94	866,75	-374,26
16.	Content Design	168,27	168,27	107,33	0	60,93	107,33	60,93
17.	Design completed	0	0	0	0	0	0	0
18.	Development of technical specifications	353,84	344,42	212,42	-9,42	132,00	218,24	135,61
19.	**Revision**	740,69	730,32	205,03	-10,38	525,29	230,60	590,80
20.	**+ Coordination with the customer**	0	0	0	0	0	1143,81	348,03

Based on the values of the earned value method, it is safe to say that the supervisor should take any action to normalize the progress of the project because by today's loss of the developer is about 14000 rubles, and if nothing is done, they will grow with each passing day due to unfinished tasks.

5. Conclusion

Developed and implemented system integration project «AES_X1» and «AES_X2» is one of the binding elements in the infrastructure «Enterprise X». This project allows to automate the process of accounting of travel sheets and FUEL lubricants at any enterprise having its own car park. Competent and correct application of standards and programs of quality and reliability of systems will allow IT professionals to effectively take. The developed project successfully passed all necessary tests, after that the Act on reception of the integrated systems in operation was prepared.

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