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SYSTEM PROCEDURES AND ERRORS IN CLIENTS DATA SYNCHRONIZATION IN INSURANCE COMPANIES

SISTEMSKI POSTUPCI I POGREŠKE U SINHRONIZACIJI PODATAKA O STRANKAMA U OSIGURAVAJUĆIM DRUŠTVIMA

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Abstract
The paper describes activities and errors in customer integration process. It also illustrates a process model of customer data integration in an insurance company's information system. Basic business processes in insurance companies, sales and damage are the key source of data on customers. The process of business information system integration is necessarily accompanied by the process of customer data integration, as the basic entity type, i.e. the central table in the database. The decomposition of process integration was conducted and the activities of a given stage are described in detail. The process was applied and tested on damage applications and insurance sales applications. The process of customer data integration is decomposed into three stages: analysis, preparation and integration. Each stage consists of more than one activity, and certain activities are further decomposed. The process model of customer synchronisation is also shown, as one of the key activities in customer data integration.

Sažetak
U radu se opisuju aktivnosti i greške u procesu integracije stranaka. Prikazan je i model procesa integracije podataka o strankama u informacijskom sustavu osiguravajućeg društva. Temeljni poslovni procesi u prodaji i štetama osiguravajućeg društva su ključni izvor podataka o strankama. Proces integracije poslovnog informacijskog sustava nužno prati i proces integracije podataka o strankama, kao temeljnog tipa entiteta odnosno centralne tablice u bazi podataka. Izvršena je dekompozicija procesa integracije aplikacije štete i prodaja i detaljnije opisane aktivnosti pojedine faze. Proces integracije podataka o strankama dekomponiran je u tri faze: analiza, priprema i integracija. Svaka faza sastoji se od više aktivnosti, a neke aktivnosti su dalje dekomponirane. Prikazan je model procesa sinkronizacije stranaka kao jedne od ključnih aktivnosti u integraciji podataka o strankama.

1. INTRODUCTION

The process of customer data integration will differ depending on the observed industry (retail, energy production, communication, shipping, etc.) or the sector (banks, insurance companies, healthcare, government administration, etc.). Application or implementation of a certain system for ERP (Enterprise Resource Planning) or CRM (Customer Relationship Management) will not solve this problem /**1**/. Data integration demands that organisation put a lot of effort to obtain data without redundancy and errors by unifying data.
In insurance operations or sector, customer data governance boils down to basic business processes in sales and damage. Information systems (applications) for policy and damage management are basic sources for gathering and managing customer data /**2**/.
In the case of the observed business information system of the insurance company, around 100 sets of customer data (different databases) were found in the information system /**3**/. The information system integration process causes customer data integration. The customer is the central table in the database of the insurance company IS. This problem can be solved in different ways, depending on the observed industry or sector.
Purchasing a finished solution will not solve this problem in a heterogeneous environment /**4**/. It is necessary to create a central place or database on customers which will serve as a customer data source for all applications. In the insurance sector, which uses a heterogeneous information system,

customer data integration can be performed through integration of these data items from information subsystems Sales and Damage. This paper proposes a process model of customer data integration in such an environment.
The integration process decomposition was conducted and three stages were defined: analysis, preparation and integration. Each stage consists of more activities, which are listed in a table and all integration process activities are described in detail. Certain activities are further decomposed. One of the key activities from the preparation stage is described in detail, this being Synchronization of corporation data according to data provided by the Central Bureau of Statistics.

2. INTEGRATION PROCESS DECOMPOSITION

The analysis of the integration procedure defined three stages, namely: Analysis, Preparation and Integration. Each stage consists of activities, and certain activities are further decomposed into subactivities. The stages and the corresponding activities are shown in Tables 1, 2 and 3.

Table 1: STAGE 1. Analysis

No.	Activity
1.	Forming the vision and expected aims 1.1 Determining business and technological obstacles for customer data integration 1.2 Developing strategy for creating quality data on customers
2.	Organization's information system analysis
3.	Customer data analysis in each information subsystem of the organization
4.	Designing a unique customer data model

Table 2: STAGE 2. Preparation

No.	Activity
1.	Merging common coding tables
2.	Data cleansing and conversion of customer data
3.	Customer data procurement
4.	Synchronization of corporation data according to the Central Bureau of Statistics
5.	Defining data ownership and data stewardship
6.	Planning modifications of certain applications
7.	Modifying the application data model
8.	Modifying the application database
9.	Modifying software solution
10.	Business organization education

Table 3: STAGE 3. Integration

No.	Activity
1.	Designing the customer database physical model
2.	Loading repository with data
3.	Linking certain applications on a common repository
4.	Maintenance of the integrated customer database 4.1 Procurement of data dictionary 4.2 Procedures for normalization and data coupling 4.3 Procedures for the transfer of customer traffic data

3. DESCRIPTION OF INTEGRATION PROCESS ACTIVITIES

This chapter describes in detail stages and activities acquired from the decomposition process.

3.1 STAGE 1. Analysis

Stage 1. Activity 1. Forming the vision and expected aims.

It is common that business organizations have customer data in more than one information system. One can come to a conclusion that the data is fragmented or inconsistent to a large extent /**5**/. Data organized in this manner hardly ever represent real value and quality for a business organization. The question is why would we want to integrate customer data and how can we represent advantages that are expected in the end? The vision implies reaching certain aims and possible ways of realization. Customer data integration can set certain goals like: lowering the expenses by consolidating different systems, process standardization, increasing data quality, lowering the existing scope of jobs concerning data synchronization, improving conditions in order to meet various standards and security regulations, reporting standards, etc.

Stage 1. Activity 1.1. Determining business and technological obstacles for customer data integration.

The obstacles connected to the business side are: those of internal policy, organizational structure, undefined data ownership, non-existence of executional sponsor, non-existence of an adopted program on data quality, non-existence of a developed customer data governance process. Obstacles connected to the technology are mostly in: heterogeneous information systems, data fragmentation, unconnected operative and analytic systems.

Stage 1. Activity 1.2. Developing strategy for creating quality data on customers.

The customer data integration process is not self-sufficient. No matter whether the final aim is to introduce a unique database, data store, ERP or CRM system, the quality of data is the most important component and should be taken as a strategic business goal, and not solely as an information technology problem /**6**/. Since the data is influenced by numerous processes, it is highly likely that the processes will influence the quality of data. The processes which have a negative influence on data quality can be grouped into various categories /**7**/. The synthesis of all measures and procedures can aid in defining an adequate strategy for the creation and maintenance of quality customer data.

Stage 1. Activity 2. Organization's information system analysis.

An information system is built by integrating subsystems based on common data. Customer data integration necessarily demands the analysis of the existing information system, which is basically composed of more subsystems. It is crucial to understand an information system, to know its behaviours and processes at all levels. The result of information system analysis is a list of all applications (different subsystems) and the corresponding customer databases.

Stage 1. Activity 3. Customer data analysis in each information subsystem of the organization.

Since the system is decomposed into information subsystems, the analysis of each subsystem is performed. The analysis resolves which subsystems are key elements in gathering the customer data. The following tasks are performed: forming data list (attributes), listing and determining ways of using applied logic controls, verifying the used coding system, determining ways and rules at customer identification by using an identification number and subnumber, determining synonyms. The aim of the analysis is to "make a photo" of the system state at the data level which will at later stages of preparation serve to determine what enters the section of common attributes within each information subsystem.

Stage 1. Activity 4. Designing a unique customer data model.

Based on the analysis of customer model similarity and difference in information subsystems of sales and damages, a new unique customer data model is defined. The new model obligatorily contains a set of attributes which is common to all applications and all the rest attributes which are specific to certain application systems. At the end, the unique customer data model will demand certain modifications, i.e. application redesign. It is desirable that these modifications are as less demanding as possible, concerning time and human resources. One of the possible solutions is to accept one of the used data models as "primary", so this will reflect on a smaller scope of total modifications.

3.2 STAGE 2. Preparation

Stage 2. Activity 1. Merging common coding tables.

Consolidation and merging common coding tables is conducted as a part of preparation in the process of customer data integration. Here, the rule is that the mandatory section of data in information subsystems Sales and Damage needs to be identical. The consolidation covers all those coding tables which, using their data, form or complete a set of attributes of a unique customer, for example coding

tables of territorial/administrative organization and insurance documents. For merged coding tables authorization rights need to be set, i.e. reach the decision who has the right to update them. This change reflects on all applications, in terms of limiting the modifying rights; such merged coupling tables are read-only.

Stage 2. Activity 2. Data cleansing and conversion of customer data

The validity analysis of customer data in existing databases and classification of problems emerging at the process of customer table integration imply the complexity of the integration process and demand a certain degree of data cleansing prior to the process of synchronization and formal data merging into one database. Customer data cleansing depends on the definition and application of permanent customer identification (company's registration number, personal identification number – (croat. JMBG - Jedinstveni matični broj građana), internal identifier which is established by the corporation, etc.). Determining a permanent and reliable identifier is a priority. This data can be available and at disposal for use (e.g. company register number – corporations) or, in time, liable to law changes, in terms of the rules of use (e.g. JMBG). If there is no reliable external source for information on the customer identifier, it is recommendable to introduce an internal identifier which is determined by the corporation or the information system owner. Activities of customer data cleansing and conversion can point to a set of erroneous customer data in an information system, which is described in detail in chapter 4.

Stage 2. Activity 3. Customer data procurement.

The activity boils down to procuring relevant customer databases. For corporations (companies) this is, without doubt, the Central Bureau of Statistics, which can deliver customer data with a set of attributes (company registration number, subnumber, name, operation code, town number, zip code, street and street number, account number, etc.). For other subjects (trades, notary public, attorney, surgeries and polyclinics, various citizens associations), a few relevant sources can provide data.

Stage 2. Activity 4. Synchronization of corporation data according to the Central Bureau of Statistics.

In this activity stage customers are linked from information subsystems Sales and Damage using a common identifier in a separate table. The existing data structure in applications (tables and columns) does not have to be modified for the needs of synchronization, but only for new business needs. A chosen relevant data source is used for new customers as well, which enter both information subsystems in the same manner. The process of synchronization can be long-lasting, which depends on total number of customers in the database and the success of a business organization in initiating this process with a chosen number of users. This is why this activity can be performed parallel to the following activities of this stage. The process model of synchronization of corporation data is shown in chapter 5.

Stage 2. Activity 5. Defining data ownership and data stewardship.

Data governance is a process focused on quality, consistency, usability, safety and availability of information /**8**/. Data ownership is assigned to individuals or groups within an organization which can realize, create or have significant control over data content. Data owners usually belong to business, rather than to technological part of organization. It is essential that this role be recognized and certain business parts should be assigned data ownership. Data stewardship is the second important role which needs to ensure a continuous maintenance of data quality. To realize these aims, it is necessary to perform education in the organization on all levels. The final aim is that data stewardship is recognized as an important business function which will treat data as valuable property of a business organization.

Stage 2. Activity 6. Planning modifications of certain applications.

As a result of customer data analysis in each information subsystem and consolidation of common coding tables, it is reasonable to expect certain modifications of some applications. Needed modifications should be planned on the level of each application system and recorded into a common table with the evaluation of the required realization time. Planning and designing an information system can be performed following the information system development methodology.

Stage 2. Activity 7. Modifying the application data model.

Based on the conducted analysis a task list is formed for a logical synchronization of the customer data model. Information subsystems Sales and Damage should, on the model level, synchronize more key attributes, such as types and kinds of customers, customer identification using company registration number or a generated sequence, address and customer accounts.

Stage 2. Activity 8. Modifying the application database.

Modifications on the level of the logical model necessarily reflect on the existing data structure

(tables and columns) in the database. Physical model modifications can be very demanding in terms of required system or time resources. This is why this activity needs to be planned out carefully, and previous testing must be conducted.

Stage 2. Activity 9. Modifying software solution.

Modifying logical and physical data model also imply modifications of software solution. One of the basic questions that should be answered by the previous analysis is how to approach the central base Customers, without major modifications in all applications. The most acceptable solution is to apply the "view" option of the available system for database management. This way, by applying described processes, a gradual adjustment of application systems to the forthcoming integrated customer database is enabled, with no radical interventions in the program code. Modifications which relate to activities of synchronizing the logical and physical model are unavoidable.

Stage 2. Activity 10. Business organization education

This activity should not be observed or accepted as isolated and strictly tied to one period of time. Education is mentioned through the activity of defining data ownership. Almost all activities in the preparation stage directly influence the behaviour of application end-users. Merging common coding tables, using external data sources, logical model synchronization, modifying work authorities and software solution; all these activities tell the user to approach the system in a different manner. All modifications need to be announced in due time, and a corresponding education and support in everyday work need to be ensured.

3.3 STAGE 3. Integration

Stage 3. Activity 1. Design the customer database physical model.

System architecture needs to be evaluated, from the aspect of operational needs of customer data, and a decision has to be reached on how to realize integration and a unique view on customer. Customer data can be integrated on five different technological levels in order to create a new form of unique view on customer. Integration on the level of database is the best solution /**9**/. If data consistency of more business applications is insured and, at the same time, available technology for data quality is applied, one can expect to reach the highest level of customer data integration in an information system.

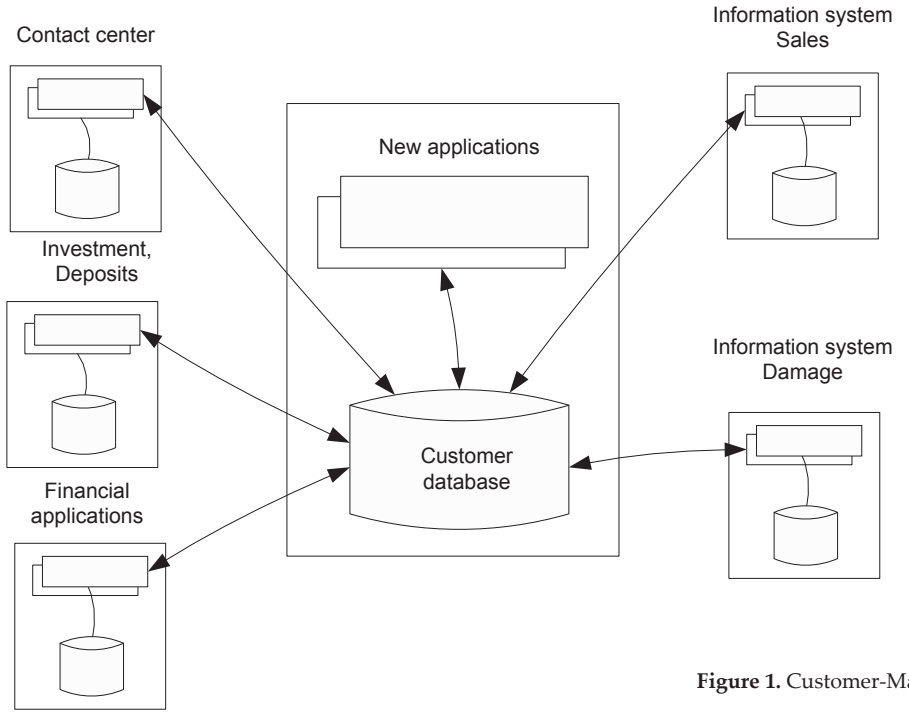

Figure 1. Customer-Master Centric model

In order to ensure integration on the level of database, a new customer database needs to be created; one which will behave as a record system available to all applications, the so-called CMC model (Customer-Master Centric), shown in Figure 1. A new customer database has to meet the needs of all applications, in terms of descriptions and attribute definitions, indexes and keys. This model has its advantages in a flexible and controlled architecture, and in a created repository which contains exact and complete customer data. On the other hand, such a solution seeks a sound and

controlled data model, the application of data quality control methods and a significant amount of integration process and data synchronization /**10**/.

Figure 1 illustrates the connection of all applications to the unique database Customer. These are the typical applications which are being used in every insurance company: Sales and Damage as means of support to basic business processes, then accounting-financial applications, investment and deposits. It also shows the Contact center as one of the communication channels with insured parties which can be supported by modern technological solutions. Ideally, it would be business and computer-wise that this function in its performance relies on using the unique database Customers. Such a concept necessarily implies that all new applications use the unique database Customers.

Stage 3. Activity 2. Loading repository with data.

Based on the activities in the preparation stage, what follows is the loading of repository with customer data. Customers which were previously synchronized (corporations), then others (individuals, trades) which have the same company registration number in both information subsystems Sales and Damage, are connected to a common identifier. Loading includes the transfer of other data that belong to the customer (addresses, accounts…). Other customers which cannot be connected (different register numbers and/or customer name) are simply copied to a common repository (database).

Stage 3. Activity 3. Linking certain applications on a common repository.

New customer data structure has to be available to all applications from the information subsystem Sales and Damage. This is why, after loading data, required indexes, keys and other data views and triggers are created, and a common customer identifier sequence is implemented on the level of database. It is necessary to apply a standardized set of user rights for manipulating customer data on both information subsystems.

Stage 3. Activity 4. Maintenance of the integrated customer database.

Customer data integration process is definitely complex and long-lasting. By realizing an integrated customer database, the prerequisites for quality maintenance and data usage were met. The process of data cleansing is a routine which needs to be applied continuously over all customer data which enter the system through all channels of policy sales and damage reports. An integrated database enables customer grouping according to different criteria and roles, as well as its constant improving, which depends on quantity and the available data source and its quality. Three basic activities can be defined: procurement of data dictionary, developing procedures for normalization and data coupling and developing procedures for the transfer of customer traffic data.

Stage 3. Activity 4.1 Procurement of data dictionary.

The activity boils down to the procurement of relevant databases on other customers – subjects which are not in the register of the Central Bureau of Statistics, like the following: trades, notary public, attorneys, surgeries and polyclinics, various citizens associations. On an integrated database, other data cleansing methods can be applied, so the users can be the following data dictionaries: names, name prefixes, surnames, street, street prefixes and towns.

Stage 3. Activity 4.2 Procedures for normalization and data coupling.

Procedures for normalization of customer name and address perform tasks of separating existing records in the database to words, tokens (tokenization), and their normalization. The process of normalization of each input parameter is performed so that the corresponding data dictionary is being searched, in order to see whether it contains the word, token which completely responds to the wanted one, or is satisfactory and matches to the closest degree.

The procedure for coupling data has a task to find the most similar records for each record in the normalized tables and additional customer data. The similarity is defined by weight function where the weight factors are defined in advance and saved in the database, but the possibility that the user can determine these using a corresponding interface remains open. The final result, i.e. data on coupled data, is saved into the database.

These procedures, with the help of software and relevant dictionaries, suggest that a certain data item is correct with a high probability degree, and it enables a continuous customer data cleansing.

Stage 3. Activity 4.3 Procedures for the transfer of customer traffic data.

Based on the reached results there are customers who are candidates for connecting, that is integrating their data on the level of the information system. This connecting can be performed automatically and manually, but, due to data sensitivity, a semi-automatic method is recommended. Implemented procedures will mark potential candidates, and the user of a certain business area needs to give a final decision on data integration. After that, a corresponding procedure will conduct the transfer (integration) of traffic customer data.

4. PREVIEW OF ERRORS IN THE PROCESS OF CUSTOMER INTEGRATION

The analysis of customer data validity in existing databases Sales and Damage, relates to more key attributes which describe the customer. Primarily the customer identity needs to be established, on the level of corporation identification number or personal identification number. Besides this primary identifier, corporations are also marked by a hierarchy on the level of subnumbers which define the organizational structure of the customer. Other attributes relevant to business are, without doubt, type of person (corporation, individual, trade, undefined), exact name, operation code, town/city, zip code, street and house number, account number, contact information (phone, fax, mail address, etc.)
The control of accuracy of correctly entered type of person for both databases (Sales and Damage) on customers resulted in a large number of errors, as shown in Table 4. At the time of the synchronization process of corporations, a total of 217.091 customers have been connected. The last column of Table 4 shows the percentage of each type of error according to the total number of synchronized customers.

Type of error	Number of errors	% of error
An attempt to enter a customer with a key already existing in the database (unique index)	675	0,31
Correction of attribute at the level of the same identification number	16.267	7,49
Replacement, transition to the correct identification number	5.249	2,41
Total errors :	22.191	10,22

Table 4. Number of errors at modification according to attribute "type of person"

Table concisely shows number of errors at customer type conversion which was by mistake recorded as corporation into the correct type of person (individual or trade). There were also errors at replacing customer type, when it is necessary to perform data transition from incorrect to the correct identification number. Applied controls generate significantly smaller number of errors (unique index).
Synchronization of two customer databases (Sales and Damage) with the aim to align them, has shown that customers have errors in the shape of identification number, have no recorded addresses, city, zip code, etc. Table 5 shows types of recorded errors.
Errors point to inconsistencies and unevenness of software solution at both information systems Sales and Damage (this primarily applies to identification number and type of person). Inexistence of a certain data item (e.g. address) points to end user oversights. There is no doubt that activity from Stage 2. Activity 2. Data cleansing and conversion of customer data, will provide a basis for the following activities of Stage 2 (Planning modifications of certain applications, Modifying the application data model, Modifying software solution).

Type of error	Number of errors	% of error
Incorrect entry: corporation identification number	2.752	1,26
No address in Sales	12.762	5,87
No address in Damage	1.871	0,86
No city in Damage	3.646	1,67
No zip code in Damage; No country in Damage	3.872	1,78
Nonexistent customer name	1.079	0,49
An attempt to enter a customer with a key already existing in the database (unique index)	142	0,06
An attempt to enter or update with a value larger than the defined column	174	0,08
Customer is deleted	718	0,33
Total:	27.016	12,44

Table 5. Number of errors at synchronization of customer databases Sales and Damage

Stage 2. Activity 3. plans customer data procurement from various sources. This is especially significant for corporations which can be procured from the Central Bureau of Statistics. Table 6 points to possible problems which can emerge at the organizational structure of a corporation, i.e. that the hierarchy of a corporation in the database is not necessarily identical to the one which is defined by the Central Bureau of Statistics.

Problem	Number of occurences
subnumber 0 does not exist	11
Corporation does not exist	9
Corporation does not exist, there is no superior corporation	5
Superior corporation does not exist	85
Only subnumber 0 exists	14.301
Only subnumber 0 exists, there is no superior corporation	156
Already has subnumbers	21.149
Total:	35.716

Table 6. Problems of various organizational structures of customer – corporation

5. PROCESS MODEL OF CORPORATION DATA SYNCHRONIZATION

Figure 2 shows a process model of corporation data synchronization from Stage 2, Activity 4. The process of data synchronization starts by merging customers (corporations) from information subsystems Sales and Damage with corporations from the Central Bureau of Statistics (CBS). This merging is not in 1:1 relationship; instead, since many customers are listed more times, corporation or business unit from the CBS is linked to more customers from Sales or Damage. The performed merging needs to be additionally verified.

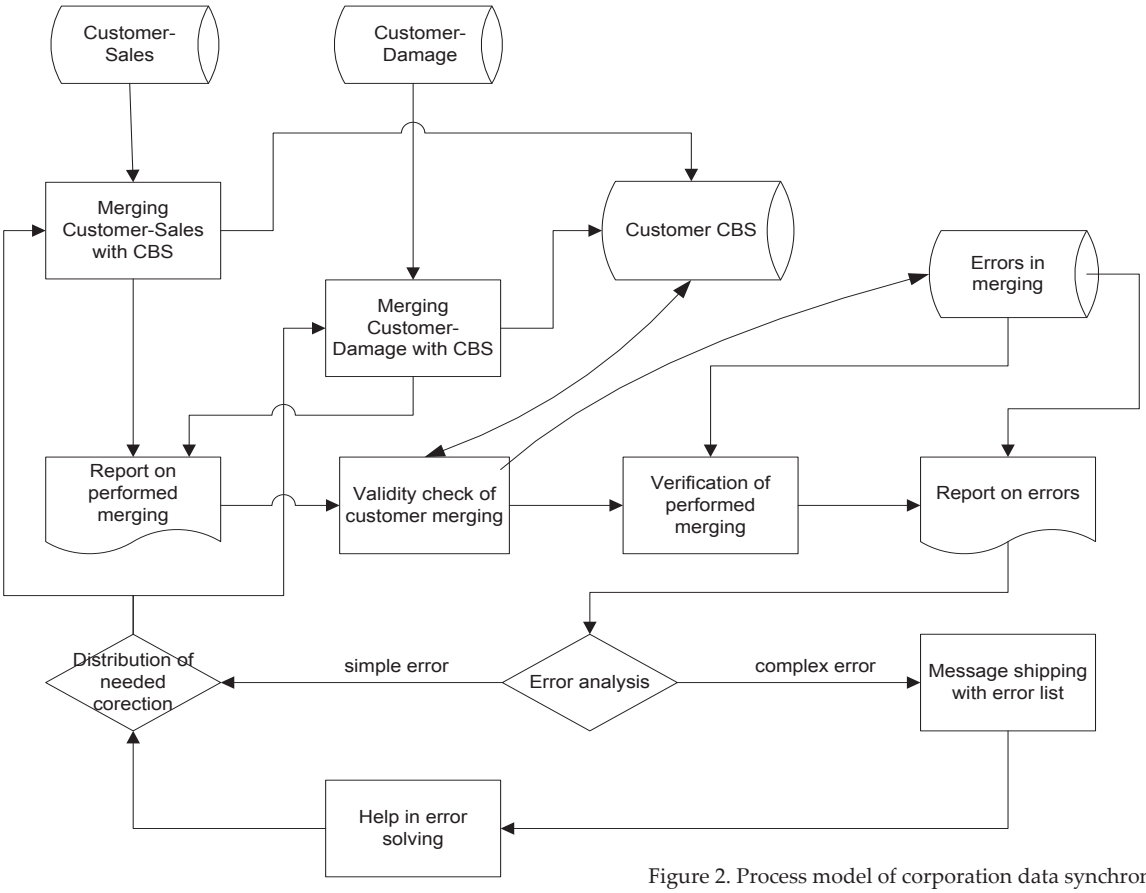

Figure 2. Process model of corporation data synchronization

Batch processing analyses verified customer merging and moves traffic data from incorrect customers to correct customers. The synchronization process can be time-consuming, which depends on the total number of customers in the database and available resources of a business organization. The process of coupling and repairing customers recorded in information subsystems Sales and Damage needs to be performed until a unique customer database is created. In an actual case, Table 7 illustrates data on the number of synchronized corporations until the point when, based on such a described integration process, preconditions for a unique customer database have been met.

Year of synchronization	Number of synchronized corporations
2004.	15.720
2005.	126.199
2006.	54.635
2007.	20.537
	Total: 217.091

Table 7. Number of synchronized corporations per year

6. CONCLUSION

The integrity of an information system is reached by setting up a common database for different applications. The problems of integration are especially obvious on Customer (business partner) as one of the key entity types in the insurance company operations. This process is time-consuming and demanding, because it seeks for non-standardized solutions in the process of integration and consolidation of customer data. Customer data is often heterogeneous and placed in more different systems. Customer data transfer among different systems is a temporary solution which is not marked by quality in providing a unique view of customers in a business and information system. A customer data integration process model is suggested in a heterogeneous information system of an insurance company using customer data integration from information subsystems Sales and Damage. The integration process decomposition was conducted, which resulted in three stages and more activities within each stage. The necessity to form a vision and strategies to create quality customer data was emphasized, which is not just a problem of information technology. Corporation data synchronization process model was described, as one of the key steps in preparation stage before moving towards the final stage of integration.

The advantage of this solution is that the existing, as well as new applications have one reference point which provides accurate, timely and complete customer data. Besides this, such an approach will enable a simple application of various methods for data quality and will serve as a central place for integration of all future applications. On the other hand, the whole process is complex and time-consuming and demands an evolutional approach which means a lot of patience, acceptance and sponsorship by key business organization subjects.

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