

Decision Making and Reduction Techniques for Tax Revenue using Data Warehouse

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Abstract — As the tax information system is service faced system in the past few years, there exists a lot of accumulated historical data where it can't be modified. So, this system failed in tracking and monitoring to the changes of tax source. The data accumulated can be wasted and can't be used properly at analyzing tax information. Today, the real challenge for tax agencies is to improve the tax collection process and to formulate optimized legislative polices to provide better taxpayer services. The existing Online Transaction Processing (OLTP) systems are not adequate to fulfill the need of complex tax collection analysis. And it is very difficult to come up with the optimized model. To make the best optimized model it has to be built around facts. It will be helpful to use a Tax Decision Support System to make strategic decisions. To solve this problem, this paper introduces the decision making activities and tax reduction methods for tax revenue. To maintain the effective tax management system, we are introducing data warehouse and OLAP techniques.

Key words — data warehouse; OLAP technique; decision support system; tax revenue; tax compliance.

I.INTRODUCTION

The taxation management system is made up four function models: sale tax analysis, enterprise income tax analysis, other tax analysis, key tax source analysis .Each model is divided into three sub-models: data analysis with different angle, complex report analysis and inquiry model which can access database directly.

Taxation management system is an analysis inquiry system that based on data warehouse. All function of it is to analyze the historical data which is stored in the warehouse and give the result. The central of operation is data inquiry. It's different from the operation target of common application such as it hasn't function of update and deletes operation.

Data cleaning, data extraction and data loading has been finished. By the use of data warehouse technique, based on the original relational database, it improves the capability of decision and analysis for tax revenue. All kinds of heterogeneous distributive databases are integrated together to form a unified data warehouse, it provides data query and analysis capabilities from multi angle and multi-level. Practice has proved that it's useful to improve the efficiency of tax operation.

Information is power only when it can be retrieved with the least possible effort, at any point of time, for any specific purpose. Many organizations have realized that in spite of having lots of data they do not find it readily accessible when needed. This problem has highlighted the need of a system whereby the data is converted into information for quick and easy use. It is in this context that data warehouse solutions become relevant.

Today, the real challenge for tax agencies is to improve the tax collection process and to formulate optimized legislative polices to provide better taxpayer services. Tax revenue forecasting mostly relies on individual's estimation and experience, but to make effective forecasting it should be fact based.

To indirectly increase revenue, tax agencies optimize their resource utilization. The existing Online Transaction Processing (OLTP) systems are not adequate to fulfill the need of complex tax collection analysis. And it is very difficult to come up with the optimized model. To make the best optimized model it has to be built around facts. It will be helpful to use a Tax Decision Support System to make strategic decisions.

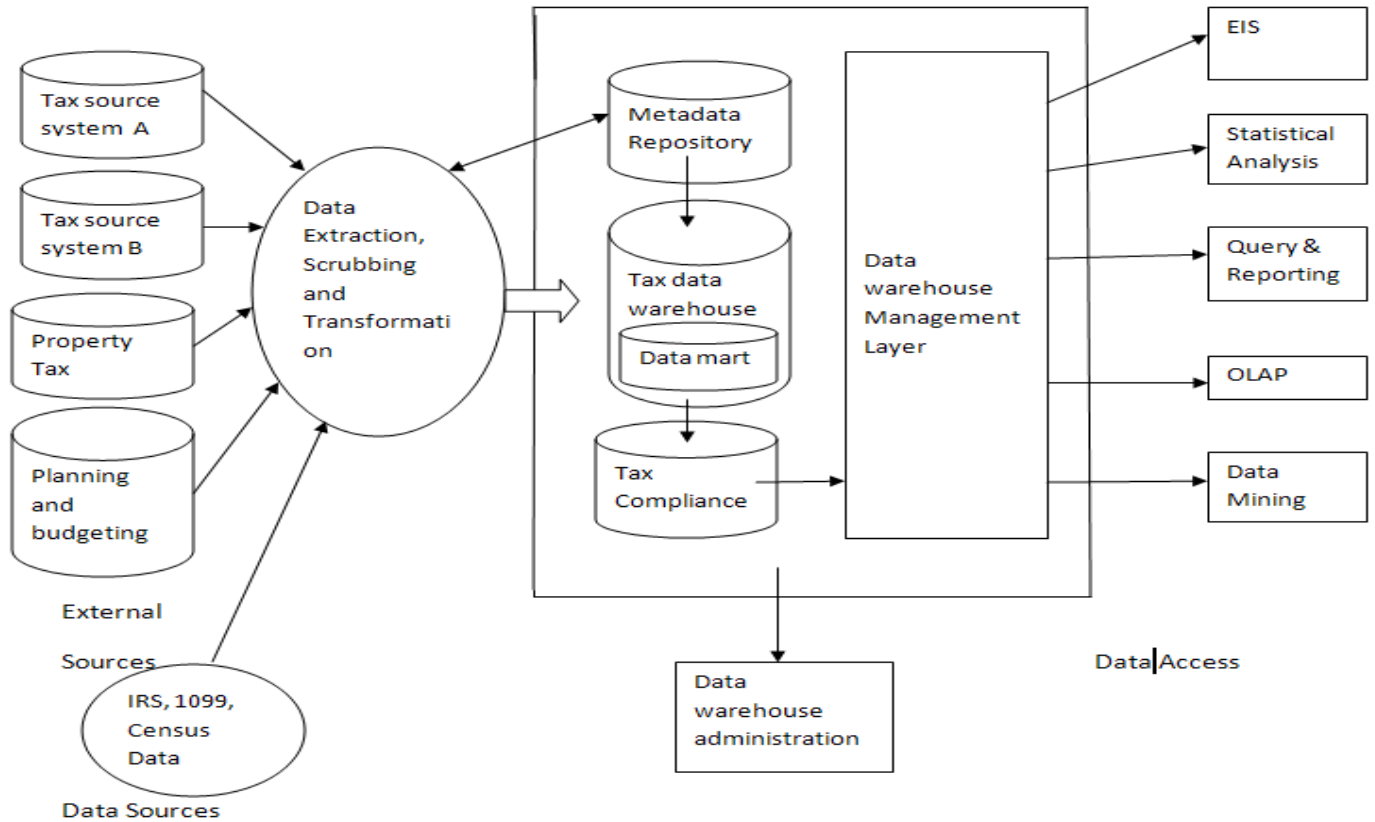


Figure 1: A Cohesive tax data warehouse architecture

II. SYSTEM DESIGN

A. The Whole System Design

The main structure of the system includes:

- Developing the data warehouse for Statistical analysis, query & reporting.
- The main function of the system includes report management system, Executive information system.

The major architectural components are:

Source systems: The systems on the left, titled “Tax System A”, “Tax System B”, “Property Tax”, “Planning and Budgeting”, “IRS”, “1099”, “U.S. Census Bureau” and other external sources represent individual OLTP systems. In this configuration data from each of these systems is uploaded into a Tax Data Warehouse, which then includes all the information available from each source.

Transformation and Extraction: Programs are developed to select, extract, clean and transform the data from divergent sources into consistent target tax data warehouse.

Metadata Repository: Metadata repository stores information pertaining to the definition of data elements. It also contains

statistics for consistent reuse, business transformation rules, source and target database descriptions.

Decision Support System: Tax DSS uses the data warehouse data and provides “On Line Analytical Processing” – referring to the ability of the system to support decision-making. This technology allows users to view information from many angles, “drill down” to detail level, or “roll up” into aggregations to analyze trends and historical information. It is the most important component of Tax Data Warehouse architecture.

Warehouse Management Layer: Administrative tools monitor the performance and usage of data warehouse, which provides a consistent view of shared data. It also helps to establish and manage business views that help insulate the business-user and application from changes to physical data structures and support data security.

Data Mart: Data Marts are data warehouses in their own right. They are built to meet particular focused needs. The data mart must not be an independent, quick and dirty data warehouse.

Instead, it should be a single area implemented within the framework of an overall plan. A data mart can be loaded with data extracted directly from the operational source systems. In tax data warehouse Tax noncompliance and taxpayer fraud detection can be considered as data mart.

B. Decision Support System

The main issue with various tax agencies is their inability to readily access and analyze the complete set of tax collection information. Moreover, the islands of related information are not suitable for decision support, which can assist a tax collection agency in the decision making process. Without tax data warehouse and DSS, a decision-maker cannot effectively resolve tax non-compliance issues like:

- How to collect millions in uncollected revenue?
- How to increase volunteer tax compliance?
- What programs and policies should be enhanced and added to facilitate better taxpayer services?

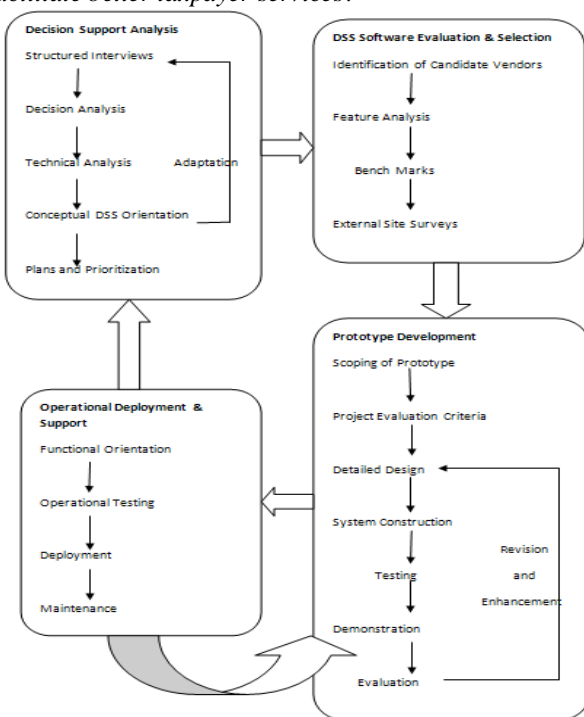


Figure 2: Decision Support Methodology

Figure 2 shows a typical DSS Development plan that is very effective in tax data warehouse development. The first stage in this process, Decision Support Analysis, involves the identification of:

- High priority application
- High level functional requirements for those applications
- Information characteristics and requirements
- Appropriate fundamental approaches to addressing user needs, including system architecture and detailed technical requirements and,
- Orientation of users to DSS concepts and their relevance to supporting user's jobs.

The first four areas are used to guide software evaluation and selection, prototype design, and prototype construction. The decision support analysis provides the initial direction to the entire DSS development process. In addition, management

orientation, to DSS that occurs during this stage helps to avoid organizational problems during implementation. It does this by fostering realistic expectations and generating commitment from the users.

1) Decision Support Analysis

It is designed to get the DSS started quickly to achieve the results. There are five basic components of the DSA approach; *structured interviews with the management, decision analysis, data analysis, technical analysis and management orientation.* These processes and their intended results are illustrated in figure 3.

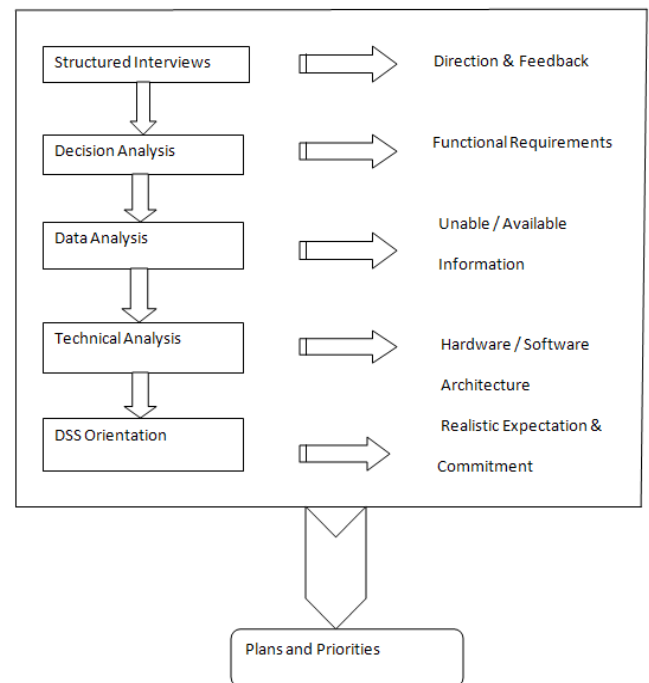


Figure 3: Decision Support Analysis

Structured Interviews: The process begins with interviews that allow managers to identify their critical needs, objectives and priorities.

Decision Analysis: At the conclusion of the structured interviews, we develop the conceptual framework to guide the identification of DSS

Data Analysis: The next step in DSA is the identification and description of the classes of data used by the functions. This is done through analysis of the functional flow diagrams. It allows us to derive design requirements for application databases.

Technical Analysis: Technical Analysis translates needs identified in the previous stages into a proposed system design with technical requirements for H/W and S/W.

Management Orientation: User needs assessment should serve to educate the DSS developer about the types of systems to build and how they will be used. The needs assessment process, along with Management Orientation, help to educate potential users and other managers about the concept of DSS and what they are realistically expecting the proposed system to do for them. By following an effective decision support methodology the Tax agency can quickly and confidently proceed with the DSS development. Business needs have been analyzed, documented and structured in an overall framework.

2) Expected solution for decision makers

The case study presented here is to show typical decision support and complex analysis needs for a city/county tax agency. A typical tax agency is responsible for collection and administration of Occupational License tax, Withholding tax, Insurance tax, Transient Room tax (based on the applicable taxes for the city/county).

The data warehouse tax data (target) is based on assumptions and does not contain any demographic facts or tax related facts of any taxpayers of the City/County of US taxation. Typical tax DSS needs for the development of the tax data warehouse are:

- Taxpayer analysis
- Revenue analysis
- Tax Non-Compliance analysis
- Revenue Forecasting
- Legislative change Impact analysis
- Fraud detection

A tax agency can apply his experience with available ready-information in tax data warehouse to discover the optimal solution for complex tax decision needs.

Taxpayers Analysis :

The tax authority needs to know its taxpayers in order to improve better taxpayer services and to maintain tax compliance .The main target is to increase the number of volunteer taxpayers and to minimize non-volunteerism. The Tax DSS provides the capability to analyze trends in the registration data with respect to various perspectives like Tax Period, Period of registration, Business Type, Tax Type, and Location. The system will be able to depict trends, such as:

- Which business types get registered the most
- What are the areas from which people get registered the most
- What is the most preferred way of getting registered

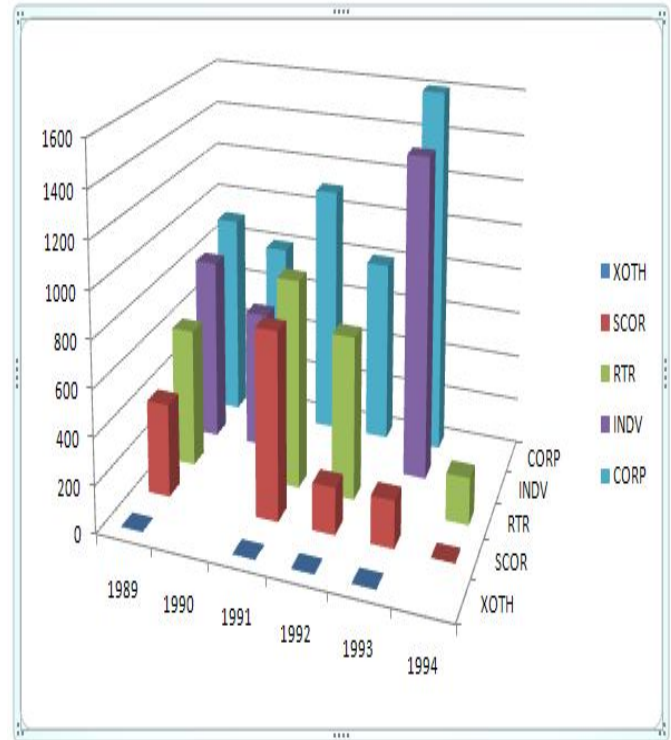


Figure 4: Tax Payers Analysis

Figure 4 depicts the distribution of *volunteer* and *non-volunteer* taxpayers with respect to Business type and year perspective. The analysis shows that there is an increase in the number of Volunteers of business type INDV (Individual) for the year 1994.

Revenue Analysis :

The Tax DSS provides the capability to analyze trends in the collected revenue from various perspectives. The common perspectives available are Time, Business Type, Tax Type, Tax Period, and Geographical Location. The system accesses tax revenue assessed data based on specific criteria.

The system can depict trends such as:

- Revenue collected and assessed for a particular tax type in a particular tax period
- Revenue collected and assessed for a particular tax type from a particular area
- Revenue collected from a selected industry, which can be further compared and analyzed with external data

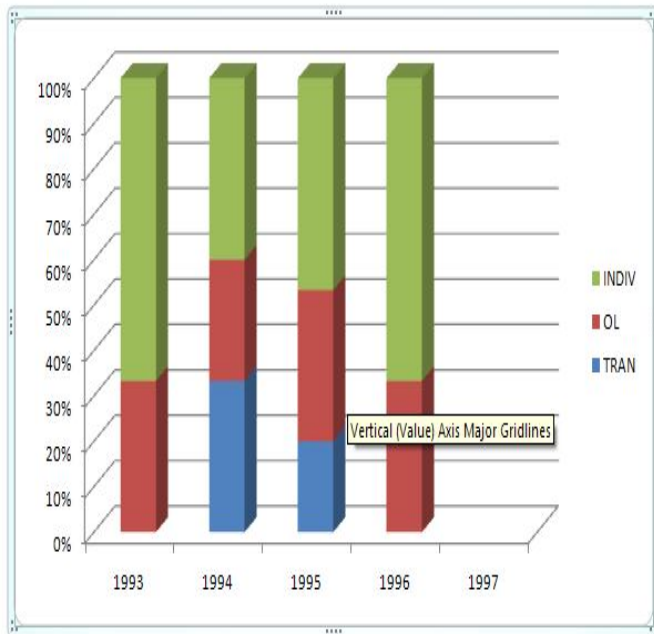


Figure 5: Tax Revenue Analysis

Figure 5 depicts the distribution of Tax Revenue collected with respect to Tax Type and Tax Period perspectives. The analysis shows that there is a constant decrease in the collections for the Withholding (W1) Tax Type from the year 1995 onwards.

Tax Non-Compliance : The main purpose of this analysis is to analyze non-filing, non-registration and under-reporting trends to locate the taxpayer category indulging in fraud. This analysis facilitates to effectively monitor Case Backlog, Resolution Rate and Payment Plan effectiveness for the specific taxpayer category.

It can provide information regarding cases with respect to perspectives such as Tax type, Tax period, Geographical areas, Case Type and Case Status.

The Tax Data warehouse allows ad-hoc and managed inquiry into current and historical Case information. The system can display trends to:

- Leverage the accuracy, efficiency and productivity of non-compliance programs.
- Optimize audit selection criteria and information.
- Enhance identification of potential non-filers of tax return and other non-compliance issues.
- Utilize the data necessary to effectively, efficiently and accurately identify the areas of non-compliance.
- Provide alert mechanism to trap the non-filing and non-registrant cases before the statute limit expires.
- Monitor progress of various non-compliance cases.

The tax DSS can provide reports and inquiries on case histories at detailed and summary levels - e.g. Case resolution rate, aging of cases, activities for employee, duration of work in progress, and compliance/ collections history. The system can provide online query tools for generating research, discovery and statistical profile reports to create compliance cases. The results can be drilled down to certain levels, for example, some of the tax types can be analyzed annually and some can be analyzed quarterly or monthly. Further, the geographical area can be drilled down to the level of city from the level of state or according to directions like northeast, south-west, south-east, north-west etc. The system can handle all the possible queries related to this area that help in decision-making. All the legal cases can be segmented and analyzed for criminal, civil, bankruptcy case resolutions.

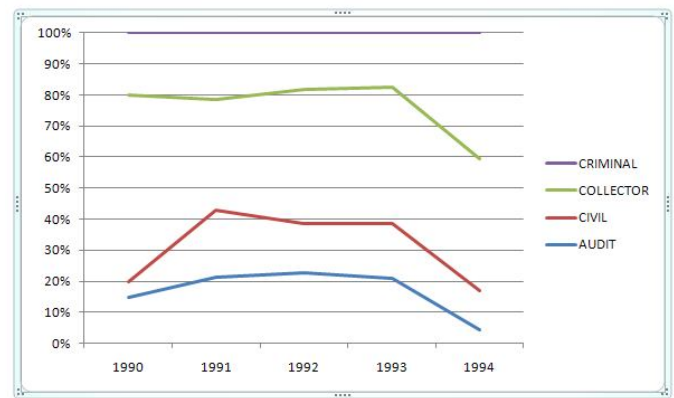


Figure 6: Tax Non-Compliance Analysis

Figure 6 depicts the resolution rate for the various types of cases with respect to Tax Period perspective. The analysis shows that in the past year there was an increase in the resolution rate only for cases in the collection category.

Tax Revenue Forecasting : Revenue forecasts are a fundamental part of the budgeting process. The formulation of reasonable fiscal policies depends greatly upon the quality of its revenue forecasts. Inaccurate forecasts can lead to budget shortfalls that require corrective measures. Under-forecasting of revenues i.e. creating substantial budget surplus, creates its own problems. A failure to forecast increases may force needless cuts in existing services and new opportunities.

Forecasting revenue is a very complex task. Forecasters operate in an environment of great uncertainty. For example in tax agencies, anticipating revenue generated by a given revenue structure depends on estimating variables such as increase in industrial growth, fluctuations in non compliance areas, employment, population, and nominal individual income. None of these variables are easy to predict. Tax Data Warehouse provides the historical revenue trends and trends about governing estimate variables. With the help of data mining predictive modeling techniques, the revenue forecast can be modeled along with estimate governing parameters.

This will produce the highest degree of accuracy in revenue forecast and will be free of errors.

Taxpayer Profiling : In tax data warehouse a comprehensive taxpayer information regarding their business type, nature of business, income, geographic location, association with other taxpayer, and property details can be maintained at one place. This taxpayer profiling can be very helpful to detect tax frauds and tax non-compliance cases.

A comprehensive taxpayer profile data can be utilized to filter out likely fraud oriented taxpayers from the data warehouse. This sample set of fraudulent taxpayers can be strictly reviewed for non-compliance. Other set of honest taxpayers can be relaxed from cumbersome audit review process. This ultimately optimizes audit resources and increases examiner productivity.

Fraud Discovery and Analysis : The tax data warehouse handles ad-hoc queries related to these areas and helps in making strategic decisions. The decisions can be based on trends regarding present uncollected revenue and tax noncompliance. The Tax DSS provides complete analysis of processed returns to identify problems related to taxpayer fraud. An integrated database blended with external data sources can be utilized to detect and discover potential taxpayer frauds.

The data warehouse integrates data from external sources, such as, government (Census or Geographical data, IRS Data, Post Office etc.) and commercial (Credit Bureau, 1099 Data etc) data sources to facilitate tax examiners and auditor with on-line data mining and query tools. This can lead to substantial increases in tax assessments and a long-term reduction in the tax gap through enhanced voluntary tax compliance.

Legislative and Regulation Impact Analysis : The Tax DSS helps to identify taxpayers affected by specific legislation, policy, or regulation. The following *What-if* analysis can be performed:

- Determine the effect of change in legislation, court mandate, policy, or regulation upon specific Taxpayer groups (e.g., Tax changes on individuals, corporations, partnerships, sub-corporations etc.).
- Support *ad hoc* queries to estimate fiscal and administrative impacts of proposed legislation or regulation.
- The tax policy and research analysis supports users in researching tax policy, establishing procedures, and providing a tool for capturing legal precedents for future reference. The impact of specific legislation is analyzed by using data warehouse as a tool to provide a resource of information.

III. Tax Reduction methods

The goal of tax planning is to arrange your financial affairs so as to minimize your taxes. There are three basic ways to reduce your taxes, and each basic method might have several variations. You can reduce your income, increase your deductions, and take advantage of tax credits.

Reducing Income : Adjusted Gross Income (AGI) is a key element in determining your taxes. Lots of other things depend on your AGI (or modifications to your AGI)-- such as your tax rate and various tax credits. AGI even impacts your financial life outside of taxes: banks, mortgage lenders, and college financial aid programs all routinely ask for your adjusted gross income. This is a key measure of your finances.

Because your adjusted gross income is so important, you may want to begin your tax planning here. What goes into your adjusted gross income? AGI is your income from all sources minus any adjustments to your income. The higher your total income, the higher your adjusted gross income. As you can guess, the more money you make, the more taxes you will pay. Conversely, the less money you make, the less taxes you will pay. The number one way to reduce taxes is to reduce your income. And the best way to reduce your income is to contribute money to a 401(k) or similar retirement plan at work. Your contribution reduces your wages, and lowers your tax bill.

You can also reduce your Adjusted Gross Income through various adjustments to income. Adjustments are deductions, but you don't have to itemize them on the Schedule A. Instead, you take them on page 1 of your 1040 and they reduce your Adjusted Gross Income. Adjustments include contributions to a traditional IRA, student loan interest paid, alimony paid, and classroom related expenses. A full list of adjustments are found on Form 1040, page 1, lines 23 through 34. The best way to boost your adjustments is to contribute to a traditional IRA.

As you can see, two of the best ways to reduce your taxes is to save for retirement, either through a 401(k) at work or through a traditional IRA plan. Contributions to these retirement plans will lower your taxable income, and lower your taxes.

Increase Your Tax Deductions : Taxable income is another key element in your overall tax situation. Taxable income is what's left over after you have reduced your AGI by your deductions and exemptions. Almost everyone can take a standard deduction, and some people are able to itemize their deductions.

Itemized deductions include expenses for health care, state and local taxes, personal property taxes (such as car registration fees), mortgage interest, gifts to charity, job-related expenses, tax preparation fees, and investment-related expenses. One key tax planning strategy is to keep track of your itemized expenses throughout the year using a spreadsheet or personal finance program. You can then quickly compare your itemized expenses with your standard deduction. You should always take the higher of your standard deduction or your itemized deduction.

Your standard deduction and personal exemptions depends on your filing status and how many dependents you have. You can increase your standard deduction and personal exemptions by getting married or having more dependents.

The best strategies for reducing your taxable income is to itemize your deductions, and the three biggest deductions are mortgage interest, state taxes, and gifts to charity.

Take Advantage of Tax Credits : Once we've tweaked our taxable income, we are ready to focus our attention on various tax credits. Tax credits reduce your tax. There are tax credits for college expenses, for saving for retirement, and for adopting children.

The best tax credits are for adoption and college expenses. Not everyone is in a position to adopt a child, but everyone could take some college classes. There are two education-related tax credits. The Hope Credit is for students in their first two years of college. The Lifetime Learning Credit is for anyone taking college classes. The classes do not have to be related to your career.

You may also want to avoid additional taxes. If at all possible, avoid early withdrawals from an IRA or 401(k) retirement plan. The amount you withdraw will become part of your taxable income, and on top of that there will be additional taxes to pay on the early withdrawal.

One of the best, and most abused, tax credit is the Earned Income Credit (EIC). Unlike other tax credits, the EIC is credited to your account as a payment. And that means the EIC often results in a tax refund even if the total tax has been reduced to zero. You may be eligible to claim the earned income credit if you earn less than a certain amount.

Increase Your Withholding : You can avoid owing at the end of the year by increasing your withholding. More money will be taken out of your paycheck throughout the year, but you will get bigger refund when you file your taxes.

Tangible Benefits :

1. A conservative 10% improvement in noncompliance can yield additional increase in tax revenue of 20-30%
2. More cost-effective decision is enabled by separating (ad-hoc) query processing from running against operational databases.
3. Better business intelligence is enabled by increased taxpayer services and flexibility of tax non-compliance analysis available through multi-level data structure, which may range from detailed to highly summarized.

Intangible Benefits :

1. Improved productivity, keeping all required data in a single location.
2. Reduced redundant processing.
3. Enhanced Taxpayer Services.
4. Ability to focus on business processes and perform a complete analysis.
5. Ability to rationalize and automate the process of building an integrated information store.

IV. CONCLUSION

A tax data warehouse clearly holds great potential for dramatic business benefits like exponential increases in collected tax revenue, improvement in the tax decision-making processes, better taxpayer services, effective tax policy formulation, increased productivity, optimization of resources, and much more.

The goal of an ultimate tax data warehouse is to provide decision-makers access to consistent, reliable, and timely data for analytical, planning and tax assessment purposes that allows for easy retrieval, exploration and analysis.

Although we have explored possible tax compliance business analysis expected by tax decision-makers and analysts, there is still much to explore. Some of these areas include forecasting and budgeting, more comprehensive taxpayer profiling, audit-program effectiveness analysis, and more complex tax fraud discovery. This tax data warehouse can be expanded with other operational sources like property tax to enhance taxpayer profiling and fraud detection.

As we introduced the reduction techniques, the tax payers can reduce their tax charges.

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