An Effective Digital System for Intelligent Financial Environments

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ABSTRACT A good set of the financial system could take care of all accounting entries and their impacts on the whole intelligent financial environment. The total flow of money and total expenditures will be reflected here. The intelligent financial system can improve the utilization of data, increase the work efficiency of financial personnel, and increase the security of financial processing services. This system could help the managers make their important financial decisions, financial budgeting, and so on. They can know about the financial conditions at any time. Based on the collection and processing of financial data, we design and analyze the related financial system to carry out the intelligent property of the financial environments. The system extends the quality of financial reporting, SOX compliance, and internal controls in a financial system, including credit management, revenue recognition, bad debts allowance. Once there is an early warning in the financial system, our proposed enhanced system could give a fast early response, and bridge a positive linkage about the planning department, finance department, and top managers, which could avoid potential exposure to bad debts. This system guarantees that the credible customers are selected, and avoid the potential risk of bad debts are incurred by a loose credit limit. It strengthens the preventive control over aging receivables management and detects the potential risk of bad debts in the earlier system alert.

INDEX TERMS Internal control, enhancement, credit management, revenue recognition, bad debts allowance.

I. INTRODUCTION

For most multinational corporations, business transaction flows on a daily basis deeply rely on the usage of application systems for automating processes and supporting high volume and complex transaction proceeding. The reliability of these application systems is in turn dependent upon plenty of technology support systems, including databases, operating systems, network, data mining /warehousing and so forth.

Furthermore, budgeting and variance analysis between budgeted and actual figures help in controlling the enterprise expenses and income efficiently. A good set of financial modules should also include cost centers, which is completely

flexible in terms of defining cost centers and their components. Cost allocations for general overheads can also be done on a pre-defined basis and required outputs could be generated for analysis purposes. Outstanding of payables and receivables with the aging analysis of both debtors and creditors are some of the features of this module. In a nutshell, a good set of modules could take care of the complete functions of any accounting department.

With this strict enforcement by Securities and Exchange Commission (SEC), compliance with Sarbanes Oxley Act Section 404 (SOX 404) [1] will take large commitments of time and efforts for both public company management and public company auditors. What's even more, finance system modules as a part of Enterprise Resources Planning (ERP) [2], [3] have no choice but to be enhanced or adjusted to meet

The associate editor coordinating the review of this manuscript and approving it for publication was Zhongming Zheng.

the requirements of SOX 404 for US public companies or most of the multinational corporations in response to SOX compliance.

Seldom there were prior literature covered with this kind of discussion or a real case example which elaborated and demonstrated the proposed system enhancement on financial modules in the compliance of SOX 404, not to mention evaluating or comparing the effectiveness of internal controls [4]– [7] or financial reporting between pre- and post- SOX 404 implementation.

Based on the collection and processing of financial data, we design and analyze the related financial system to carry out the intelligent property of the financial environments. The above is the motivation for our research. The intelligent financial system can improve the utilization of data, increase the work efficiency of financial personnel, and increase the security of financial processing services.

II. RELATED WORK

Control Objectives for information and related technology (COBIT) [8]–[10], a generally accepted framework for information technology(IT) auditors who map to SOX requirements, categorizes IT processes into four domains. COBIT originally was related as an IT process and control framework linking IT to business requirements. Beginning with the addition of management guidelines in 1998, COBIT is now being used increasingly as a framework for IT governance. Recent research suggests that certain characteristics of IT governance contribute to more effective alignment and execution of IT programs, including security governance [16], [17].

With the escalation of business scale in the age of globalization, the management of case company was taking into consideration to upgrading ERP system, in order to cope with the more and more sophisticated business transactions that incurred day by day in a huge volume and synchronize timely the updated information in each entity throughout the world.

The company began to implement Oracle ERP system in 1999, and then continuously upgraded. Its ERP financial modules could be mainly divided into six sub-modules, including accounts receivables, accounts payables, costing, general ledger, fixed assets and intercompany, etc.

All transactions which from sub-modules, and with manual journals that created for accounting adjustments, that will be imported and posted to general ledger module for eventual financial outputs. such as financial statements, managerial analysis reports, and tax purpose statements, etc.

III. PROGRAM DESIGN AND IMPLEMENTATION

The case company upgraded its ERP system in order to identify the red flags of current business flows for users in each division, demonstrate the probably enhancement functionalities supported by upgraded system, seek for further solutions to diminish control frauds caused by business risk, and optimize business workflows with value-added by standard and customized applications embedded in compliance of SOX.

A. METHODOLOGY – SINGLE CASE STUDY

A case study [12]–[15] is one of several ways of doing social science research. Other ways include experiments, surveys, multiple histories, and analysis of archival information. Rather than using large samples and following a rigid protocol to examine a limited number of variables, case study methods [11] involve an in-depth, longitudinal examination of a single instance or event. They provide a systematic way of looking at events, collecting data, analyzing information, and reporting the results. As a result, the researcher may gain a sharpened understanding of why the instance happened as it did, and what might become important to look at more extensively in future research. Case studies lend themselves to both generating and testing hypotheses.

Another suggestion is that the case study should be defined as a research strategy, an empirical inquiry that investigates a phenomenon within its real-life context. Case study research means single and multiple case studies, which can include quantitative evidence, relies on multiple sources of evidence and benefits from the prior development of theoretical propositions. Case studies should not be confused with qualitative research and they can be based on any mix of quantitative and qualitative evidence. Single-subject research provides a statistical framework for making inferences from quantitative case-study data.

Therefore, this study focuses on the improvement of the financial module based on the compliance of SOX 404 and the evaluation of the effectiveness of the internal control of the financial reporting system.

B. DATA COLLECTION AND SAMPLE DEFINED

Data was collected [21] from each financial module enhancement list including accounts receivables, accounts payables, costing, general ledger, fixed assets, and intercompany modules and balance of payments(BOP) interview conclusion according to the proposal and selection protocol used for this study.

C. ANALYSIS OF ACCOUNTS RECEIVABLES MODULE

This paragraph addresses the analysis over the accounts receivable module of the case company, inclusive of special topics on credit management, revenue recognition [18], [19], and bad debts allowance [20], [30].

1) CREDIT MANAGEMENT

The case company deploys strict credit management over customers by an integrated evaluation of customers' characteristics, operational performance, previous business relationship, and financial outcomes through mining databases that store customer master file, accounts receivables master file, and marketing master file (as shown in Figure 1, 2, and 7). Whenever a new customer applies for a credit limit or relevant amendment, the above-mentioned standards will be regarded as crucial points for further judgment by the credit management department of the case company. For instance, if
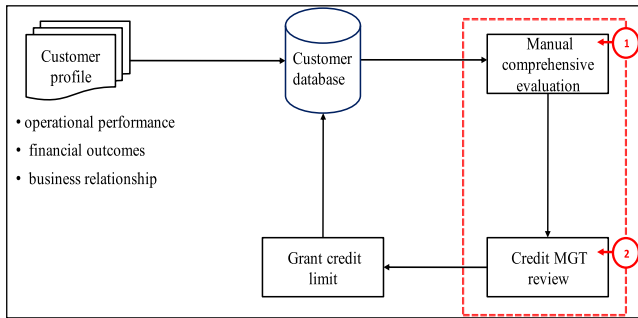
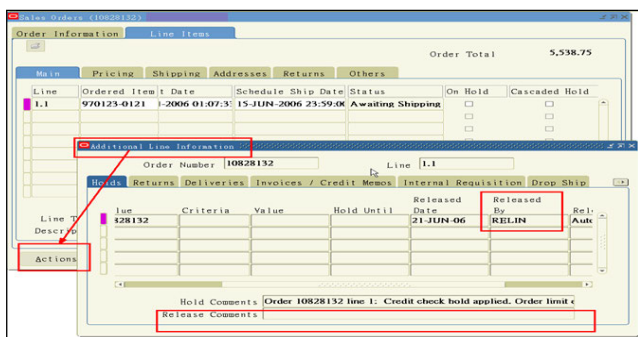**FIGURE 1. Current credit limit granting workflow.**

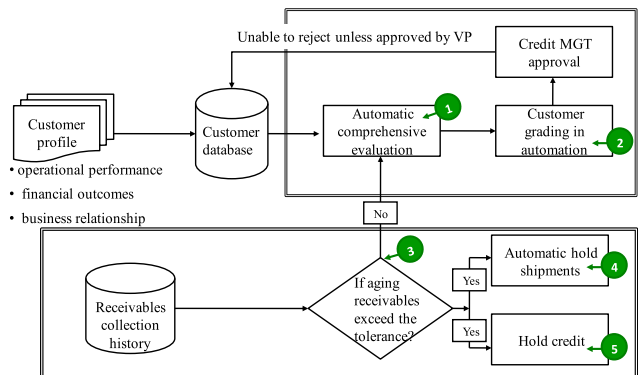**FIGURE 2. Who releases the credit hold with comments given?**

FIGURE 3. Enhanced credit management workflow.

FIGURE 4. Implementation of automatic customer credit evaluation, categorization, and grading.

FIGURE 5. Automatic hold shipment mechanism due to credit check failure.

FIGURE 6. Automatic e-mail alert regarding credit hold.

a customer with financial weakness or crisis should postpone settlements of uncollectible aging receivables with the case company, its credit limit would probably be manually reevaluated and narrowed by credit management. If a customer's aging receivables, what's even worse, should exceed the tolerance regulated by credit management, the uncollectible receivables would be treated as "bad debts" with a manual notification by email with comments to alert the customer for holding relevant shipments and to further proceed the bad debts allowance (reservation) by finance department of the case company at the same time. Only after the red flags of a credit check [29] being improved, that the credit management module would release the on-hold shipments and re-validate the credit record in the customer master file database(as shown in Figure 2).
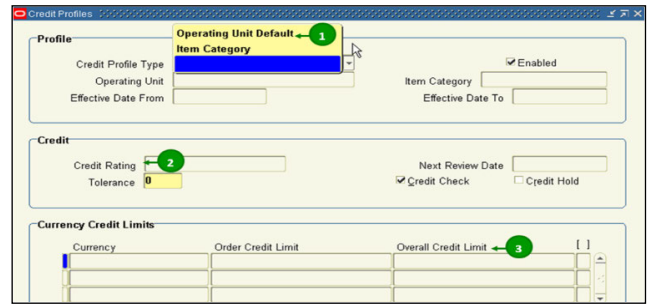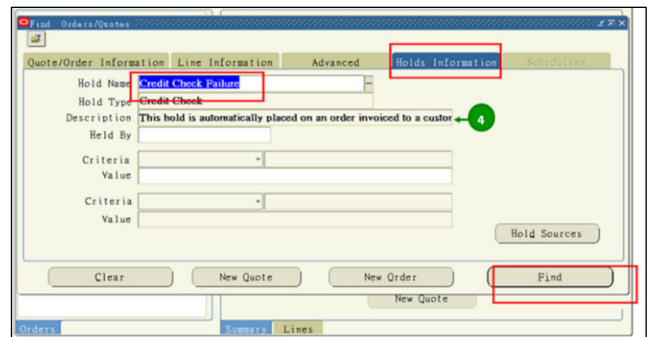
In compliance with SOX [1], [24]–[28], the credit limit of a certain customer used to be managed and controlled by manual comprehensive evaluation of customer's fundamental performance in specific aspects. Nevertheless, the current Oracle ERP Accounts Receivable (AR) module could support automatic and systematic credit management, which the case company failed to launch, between aging receivables from customers and on-hold shipments to customers.

For the sake of enhancement, the company could determine a tolerance amount of aging receivables of a certain customer in the system in advance. A formal email alert would be submitted by the system automatically to push the settlement once any uncollectible receivables should incur within a specific interval (as shown in Figure 3 and 4). Furthermore, if the uncollectible receivables from the customer should exceed the tolerance, the system would automatically hold the shipments to the customer and highlight the potential exposure for finance authorities concerned to subsequently proceed the bad debts allowance (as shown in Figure 5 and 6). Once the
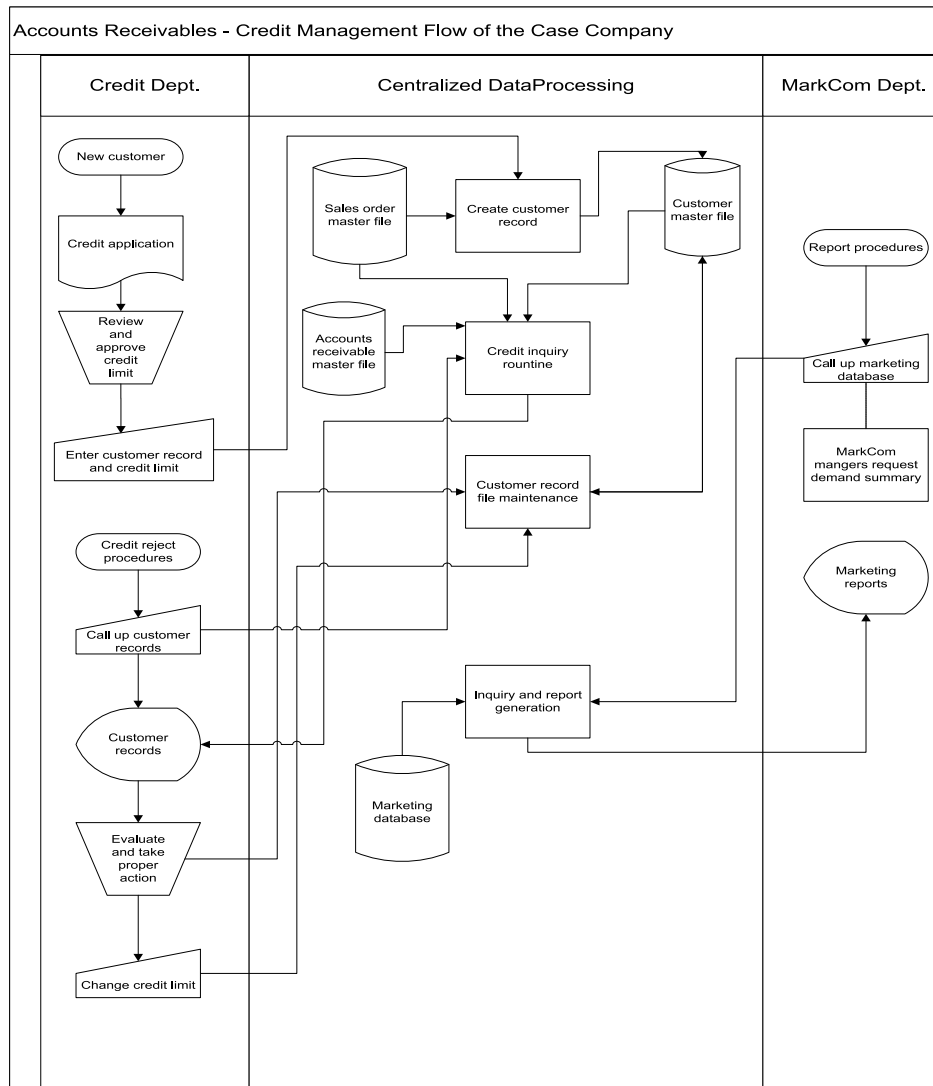
FIGURE 7. Credit management flow of the case company.

hold reasons and red flags were improved, the system would automatically release the held shipments and resend an email notification to the customer as an acknowledgment.

This system enhancement could not only strengthen the internal controls over credit management but also diminish the fraud that the credit manager of the case company may have the intention to loosen the credit limit over a certain customer on account of individual profits and therefore jeopardize the collection of aging receivables. What's even better, a prompt linkage could be bridged among the planning team, finance department, and top management of the case company once a red flag was highlighted by the system, which could avoid the potential risk of bad debts incurred by a loose credit limit.

2) REVENUE RECOGNITION

According to revenue recognition guidance by SEC Staff Accounting Bulletin: No. 101 (SAB 101) [22], [23], the revenue is generally ''realized'' or ''realizable and earned'' when the following criteria are met:

    a. Persuasive evidence of an arrangement exists;
    b. Delivery has occurred or services have been rendered;
    c. The seller's price to the buyer is fixed or determinable;
    d. Collectible is reasonably assured(as shown in Figure 8).
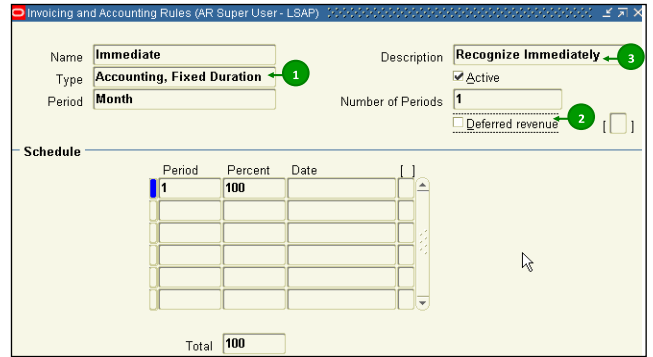
For the sake of enhancement, Oracle could support a ''deferral revenue recognition functionality'' to remediate SAB 101 criteria (b) as long as the trade sales mode of the company is unsophisticated and thus the lead time of shipments could be appropriately evaluated (as shown in Figure 10 and Figure 11). In that case, the revenue recognition function(as shown in Figure 9) could be automatically performed by system instead of always relying on manual adjustments so as to establish a stronger control to avoid manipulation of window dressing for revenue involved.

Moreover, in compliance of SAB 101 criteria (c), Oracle could render an ''advance pricing functionality'' to customize
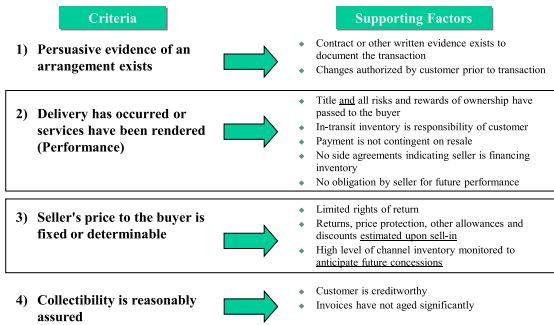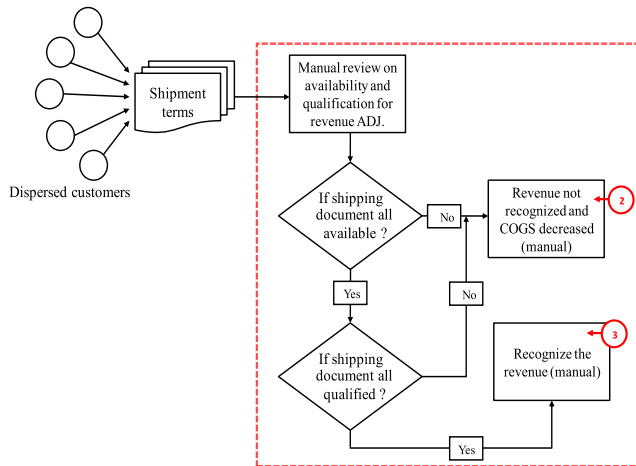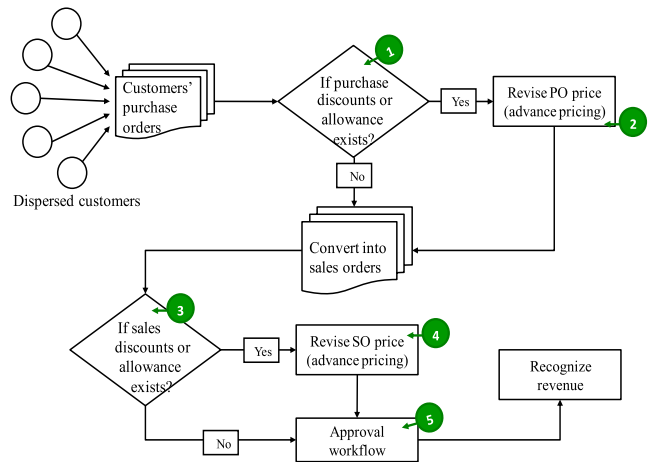
FIGURE 8. Summarization of SAB 101 on revenue recognition.

FIGURE 9. Current revenue recognition workflow.

FIGURE 10. Enhanced revenue recognition workflow in compliance of SAB101.

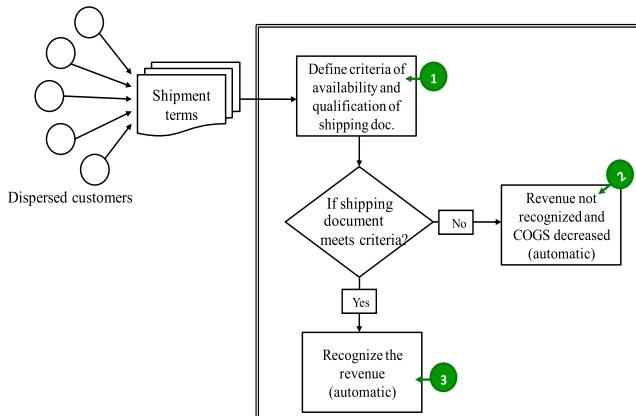
FIGURE 11. Enhanced advance pricing workflow by "deferral revenue" functionality.

FIGURE 12. Enhanced revenue recognition workflow by "advance pricing" functionality.
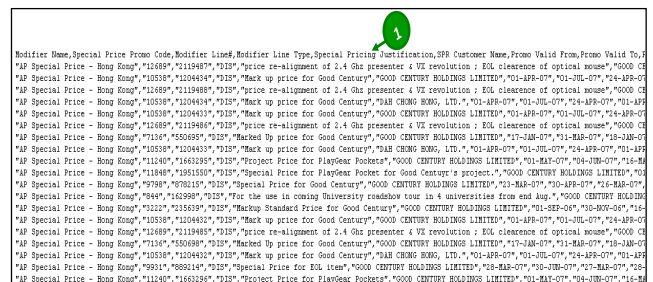
FIGURE 13. Advance pricing implementation -order discount and special deal consumption report.

a program to monitor the credit memo issued to customers so as to evaluate and analyze the price variance among buyer's purchase order (PO) price, seller's advance price, and seller's final price [32] after negotiation or discounts (as shown in Figure 12). This "advance pricing functionality" (as shown in Figure 13 to Figure 16) could strengthen the preventive control over inappropriate revenue recognition fraud that the revenue is incorrectly treated as "realized" or "earned" but

actually it should not be since the seller's price to the buyer has not yet been fixed or determinable.

To comply with SAB 101 criteria (d), Oracle could provide a "credit management functionality" to enhance the internal controls over credit management in diminishing the fraud that the credit manager of the case company may have the intention to loosen the credit limit over a certain customer due to individual profits and therefore jeopardize the collection of aging receivables. Also, a prompt linkage could be bridged among the planning team, finance, and top management concerned to ensure a creditable customer is selected and to avoid the potential risk of bad debts incurred by a loose credit limit.
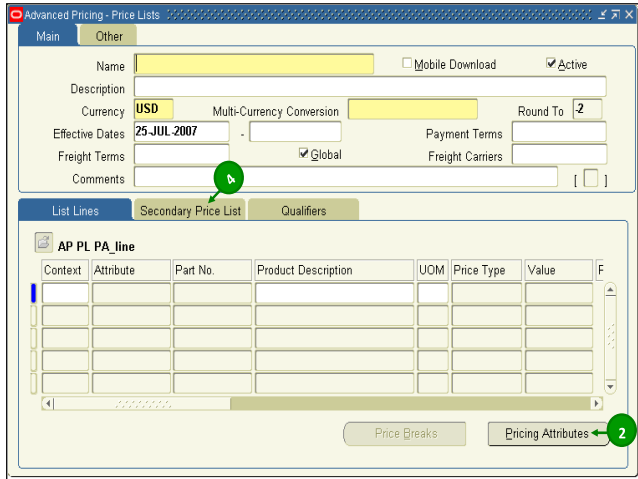
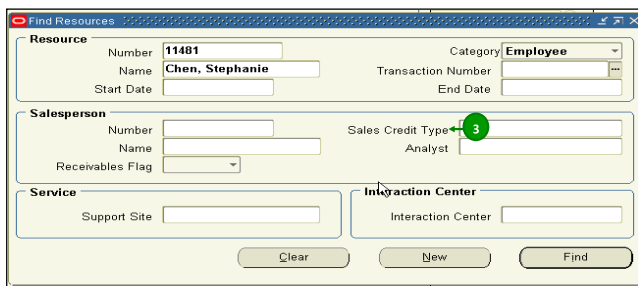**FIGURE 14.** Advance pricing implementation –amend pricing and pricing attributes.

FIGURE 15. Advance pricing implementation –validate if sales discount or allowance exists.
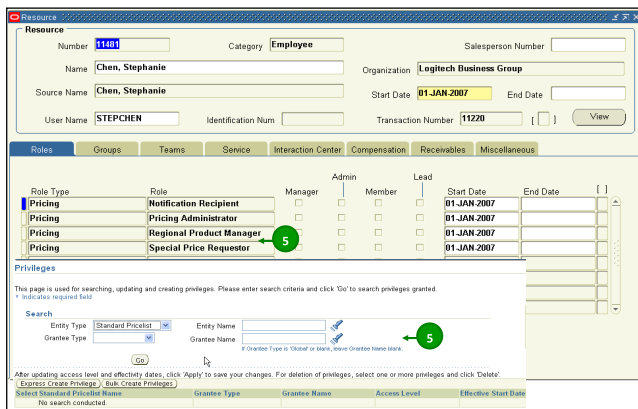

FIGURE 16. Advance pricing implementation –approval workflow.

3) BAD DEBTS ALLOWANCE

The case company relies on manual processing regarding bad debts allowance (as shown in Figure 17). According to the accounting policy of the case company, the AR accountant evaluates the AR aging report generated by the system and proposes the bad debts allowance (reservation) amount based on the predefined reservation rate for each aging receivable. The proposed bad debt allowance figures will be subsequently submitted to the regional finance controller or director for further approvals. If management concerned
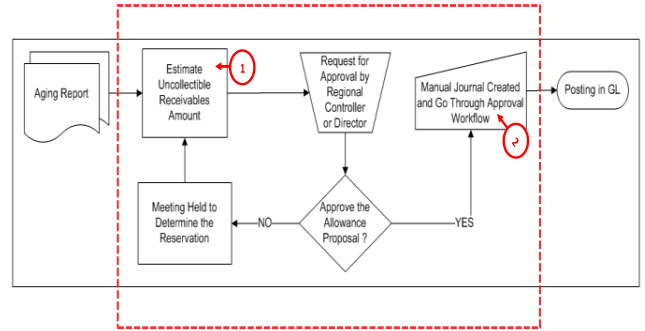
FIGURE 17. Current bad debts allowance workflow of the case company.
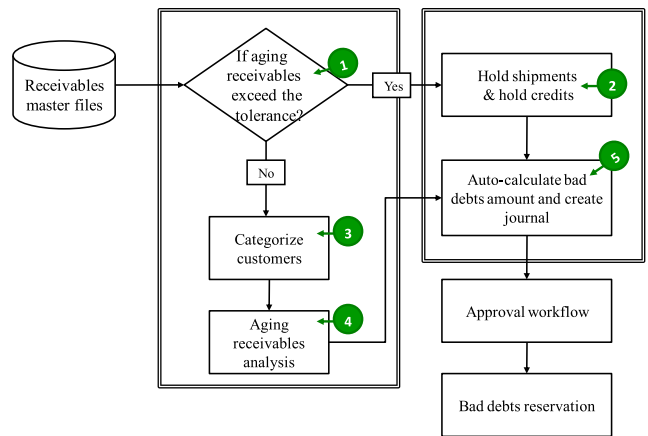
FIGURE 18. Enhanced bad debts allowance workflow.
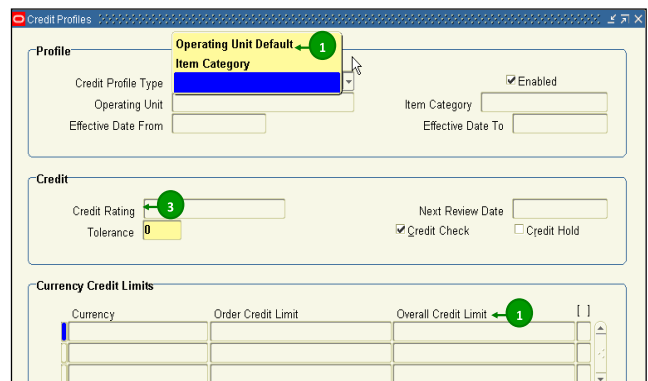
FIGURE 19. Predefine credit limit and bad debts tolerance.

disapproves of the proposed reservation, a formal meeting will be kicked off to discuss until the final amount is agreed by all. Once the propose approved, the bad debts reservation journal entry will be manually created by the AR accountant and go through approval workflow for subsequent posting in general ledger.

For the sake of enhancement, the current Oracle ERP AR module could support automatic and systematic management to monitor aging receivables from customers and auto-propose bad debts allowance amount (as shown in Figure 18). The case company could determine the tolerance of aging receivables from a certain customer in advance and predefine
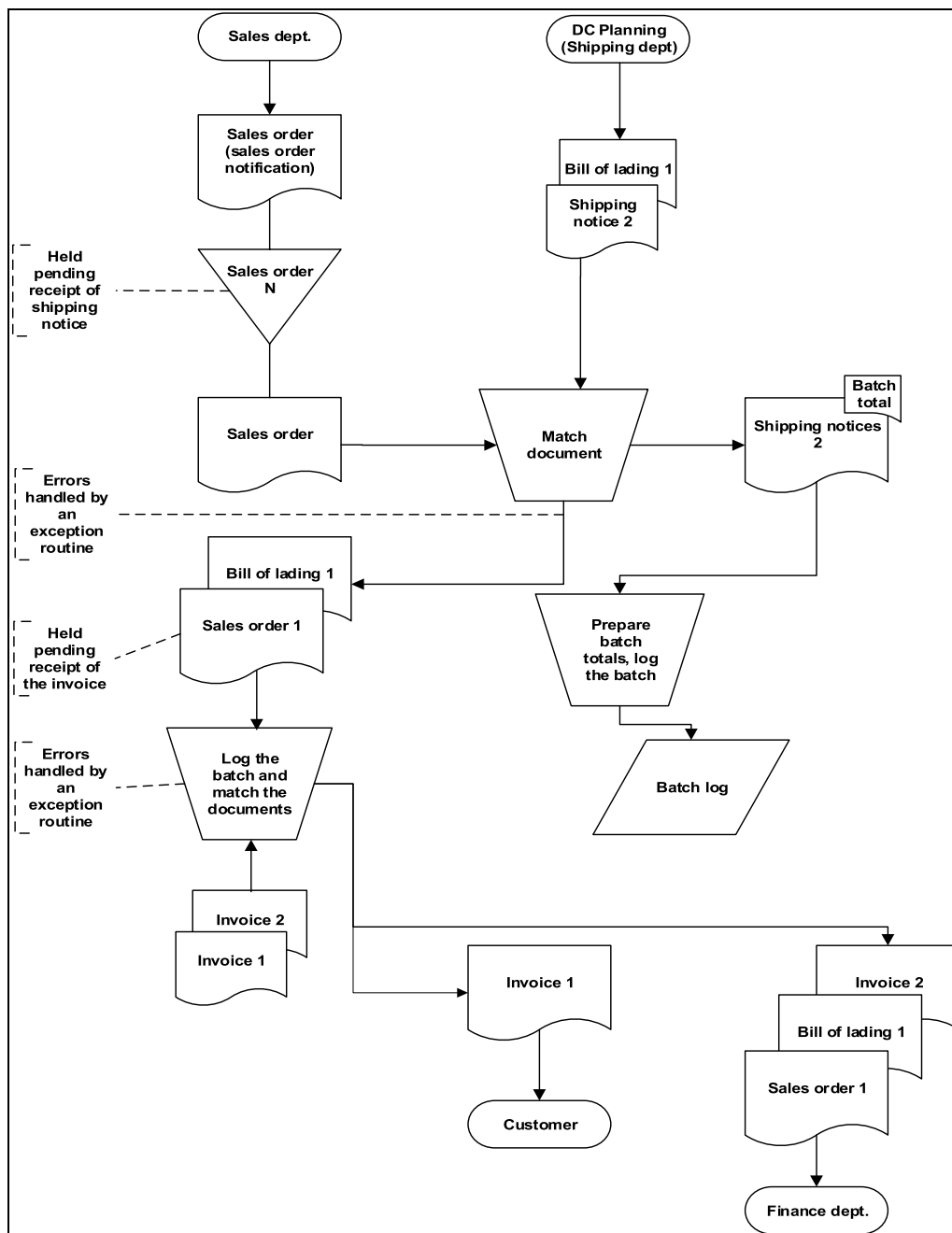
FIGURE 20. Case company accounts receivable billing processes.

the "bad debts allowance rate" for each aging receivable in a specific aging duration. After the related system default values were set up, the system would automatically hold the shipments to the customer and propose a reservation figure in a customized report to finance authority concerned to proceed the bad debts allowance once the uncollectible receivables from the customer should exceed the tolerance (as shown in Figure 19 to 24).

If finance management agrees with the reservation figure proposed by the system, an automatic reservation journal will be created and go through approval workflow for further

posting. Otherwise, the finance management could just reject the proposed amount and manually judge the eventual amount with comments given.

This system enhancement could not only provide a systematic way for bad debts allowance by case company but also reduce the manual errors possibly committed by AR accountant when evaluating and calculating aging receivables by detail. Furthermore, it could strengthen the preventive control over aging receivables management and detect the so as to comply with SOX, incur an earlier system alert for the potential risk of bad debts.

FIGURE 21. Automatic hold-shipments mechanism.

FIGURE 22. Customers categorization program.

D. ANALYSIS OF COSTING MODULE

This paragraph elaborates on the costing module of the case company by special topics on standard cost update processing. A brief intr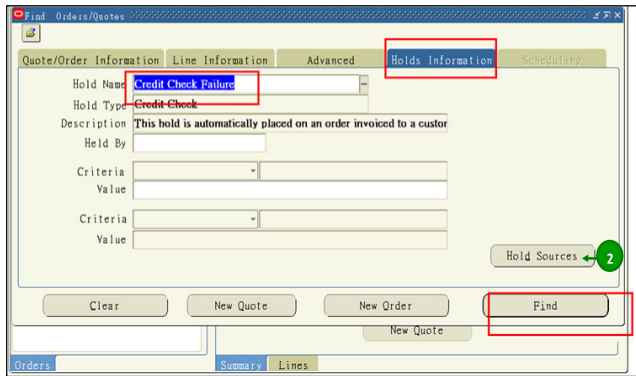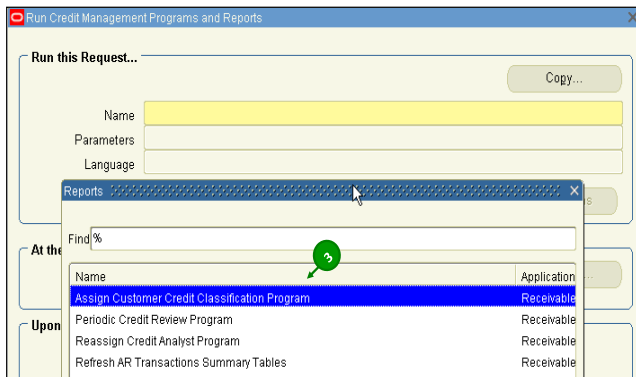oduction of original design manufacturer (ODM) standard cost update processing will be given as an example to be acquainted with the costing module of the case company as a whole.

The following is a brief introduction to the case company's ODM standard cost setting process (as shown in Figure 26).

WW Planning Team provides TW ODM Finance with "WW Demand Summary Report" for cost meeting purposes.

Upon receiving the WW Demand Summary Report, TW ODM Finance will analyze the demand projection, validate the PO status, and then select those items needed in next quarter to compile a part list for first cost publishing.

TW ODM Finance submits out the new part list to Hong Kong (HK) Sourcing Team to request them for the provision of cost for audio and gaming items / To Outsourcing-CD & Video Team in the request of providing cost for control device and video items.

TW ODM Finance, on the other hand, will concurrently raise requests to HK (Project Management)PM Team, Outsourcing-CD & Video Team, TW research and development (R&D) Team, and program managers who head ODM projects throughout the world for updates of tooling cost and project status regarding ODM projects within ABU, IEBU, CDBU, and Video BU respectively.
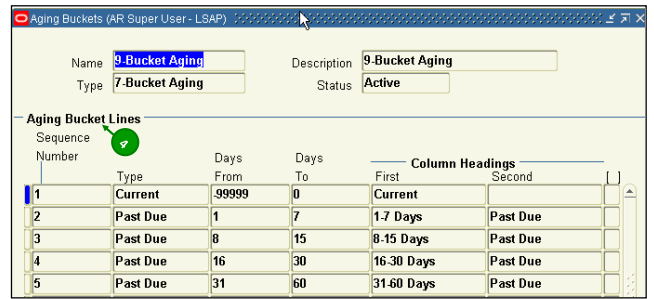

FIGURE 23. Default aging receivables analysis values.
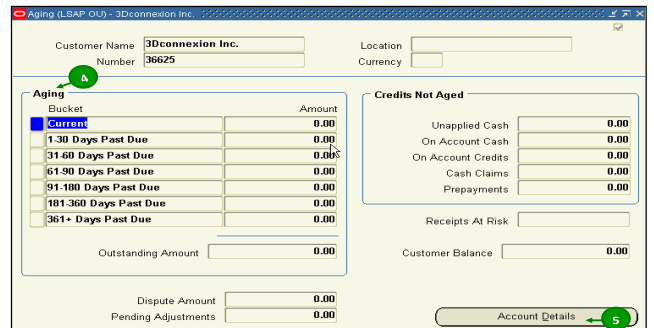
FIGURE 24. Aging receivables analysis to calculate bad debts amount automatically.

After finalizing the tooling cost, TW ODM Finance will abide by corporate rule regarding tooling amortization and calculate unit tooling amortization of each project for next quarter based on the projected demand provided by WW Planning Team.

TW ODM Finance then prepares for a preliminary tooling amortization file to all related parties for further reviews, inclusive of HK PM Team, Outsourcing-CD & Video Team, TW R&D Team, and program managers who head ODM projects all over the world. After some updates and amendments taken into account, TW ODM Finance finishes the ODM tooling amortization file to be reviewed at cost meeting. Meanwhile, material standard costs with approval in the new part list will be updated and feedbacked by HK Sourcing Team and Outsourcing- CD & Video Team.

The unit tooling cost for next quarter's standard cost setting will be determined after being reviewed and approved by top managers at cost meeting with respects to each project within all BUs.

After a cost meeting but before 1st publishing, TW ODM Finance will double confirm with HK Sourcing Team and Outsourcing- CD and Video Team about all material change reasons and the accuracy of cost information.

TW ODM Finance validates if all unit tooling costs have been amended per conclusions reached by top managers at cost meeting.

TW ODM Finance publishes standard cost one week after cost meeting with approval by finance managers.

The case company used to rely on manual efforts to collect required cost information of material and components from
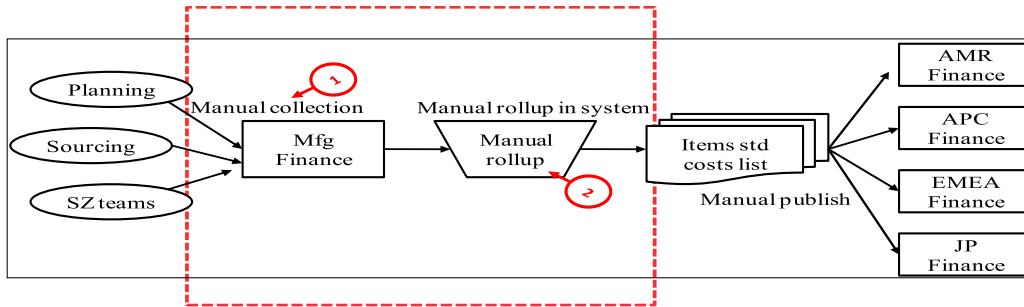
FIGURE 25. Current workflow for standard cost setup.
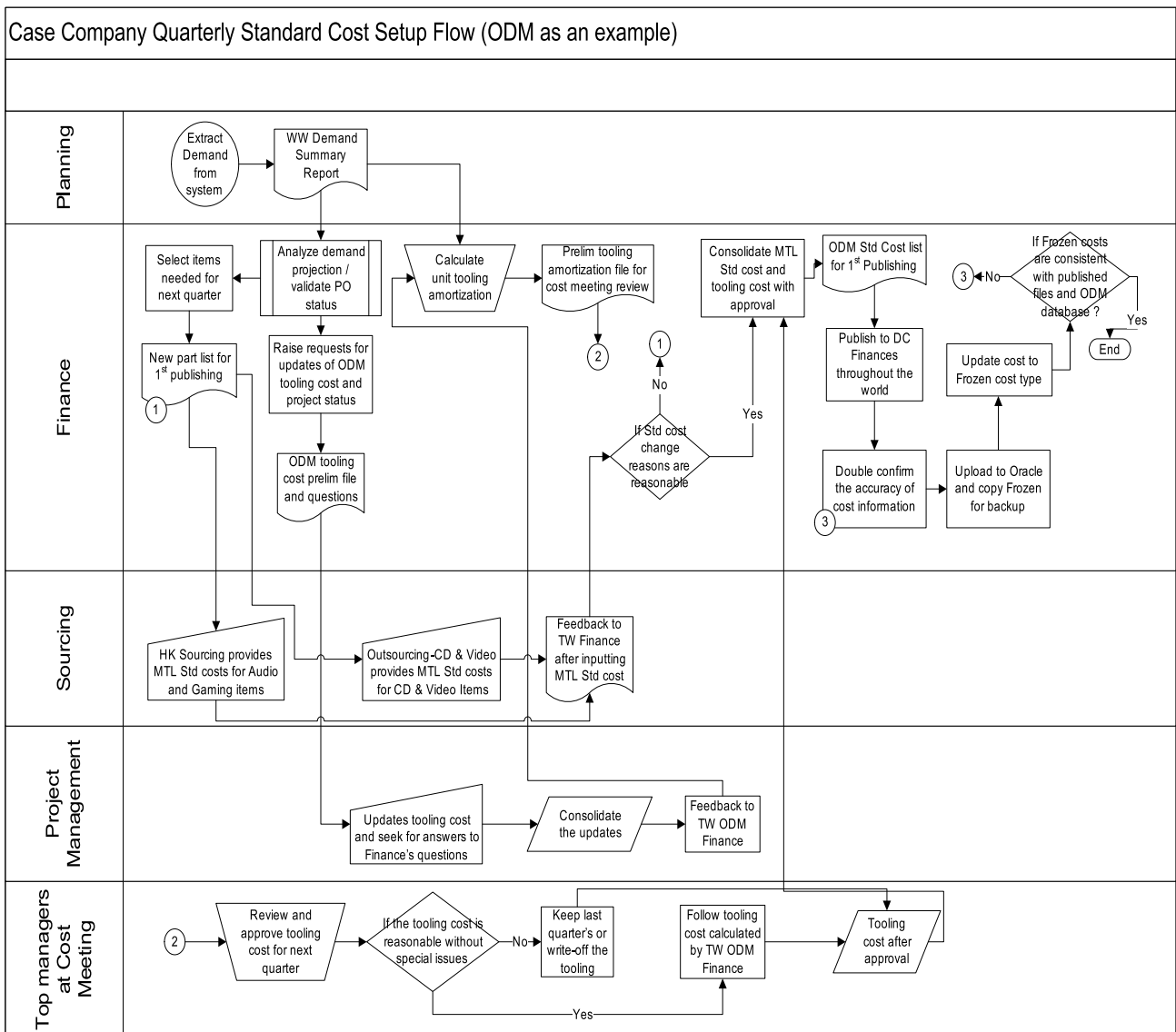
FIGURE 26. Case company standard cost setup flow.

the original sources and then roll up the collected cost information in the system to obtain the eventual cost information of finished goods. Subsequently, the required cost information of finished goods will be manually selected according to demand forecast of next quarter and consolidated in a formal

item cost list published to global DC finances for standard cost setup in system for the coming quarter (as shown in Figure 25).

In the current practice of the case company, overall processing for cost collection, cost roll-up, and cost publication
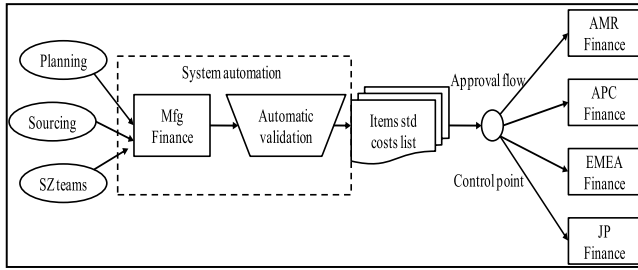
FIGURE 27. Reengineering for workflow of standard cost setup.

may inevitably involve potential manual errors, it could do serious harms to conceptual and operational business decisions such as inaccurate business transactions incurred, incorrect product marketing price setup, and inappropriate tax planning, etc.

For the sake of enhancement, the case company could implement an automatic cost setup functionality provided by Oracle (as shown in Figure 27). After enhanced, the system will be embedded with the predefined formula to verify the accuracy of the eventual roll-up cost.

Cost information from different original sources could be automatically uploaded into the system and then automatically rolled up as the eventual cost information of finished goods. This eventual cost of finished goods would be automatically verified through a comparison between trial calculation and eventual output cost information. Once consistent, the eventual cost information could be updated into

a predefined item list format and go through an approval workflow [31] before being published to global DC finances. After approved by the cost manager, the item cost list could be automatically submitted to each related party in global DC finance for further standard cost setup in the system.

In terms of SOX compliance, the enhanced system flows of standard cost setup could replace plenty of manual efforts as previous in many aspects and thus lower manual errors probably committed involved. In short, the enhanced system fortifies the preventive controls over probably manual errors committed by related parties concerned and strengthens the detective controls over the accuracy and completeness of the eventual cost information of finished goods through being embedded with a predefined formula for further verification. Moreover, the finalized item cost list could be under duplicate review on cost variance between quarters by the cost manager with relevant comments highlighted and given.

IV. CONCLUSION AND ANALYSIS
A. COMPARISON ANALYSIS BETWEEN CURRENT AND ENHANCED FINANCIAL MODULES
The following Table 1 demonstrates a comparison analysis between current and enhanced financial modules. According to the previous discussion of this chapter, the following business risk exposures are especially summarized to address the comparison analysis between the current system and the enhanced system as proposed.

TABLE 1. Comparison analysis between current system and enhanced system proposal.

Module Function	Financial modules of current system	Enhanced financial modules in compliance of SOX
Credit management (AR)	a. Fully manual efforts were taken to make comprehensive credit evaluation. b. Managerial judgment determines credit limit granting and therefore causes a loose crediting for self-profits. c. No hold-shipment mechanism exists once aging receivables exceed the tolerance.	a. Credit evaluation is completed with customer grading in automation. b. Credit managers could only accept or reject the credit limit proposal by system and have no right for adjusting. c. Receivables collection master file is incorporated with mechanism of automatic hold-shipments/credit.
Revenue recognition (AR)	a. Revenue recognition is per subjective review on shipping document and judgment by accountants. b. Revenue recognition violates SAB101 and Generally accepted accounting principles (GAAP).	a. Revenue is recognized when delivery incurred or service rendered by "deferral revenue functionality". b. Revenue is recognized when seller's price to the buyer is fixed or determine able by "advance pricing functionality".
Bad debts allowance (AR)	a. Manual calculation by accountant often results in under-estimate of bad debts. b. Managerial approval for reservation journal could cause frauds for window dressing of F/S.	a. If aging receivables exceed the tolerance, hold-shipments mechanism will launch automatically to avoid serious bad debts occurrence. b. Aging receivables analysis is applied to auto-calculate bad debts amount with journals created in automation.

The following detailed description is the improvement of the financial module in the aspect of internal control and financial management.

1) CREDIT MANAGEMENT

The enhanced system could fortify the preventive control over credit management criteria and diminish the probable fraud committed by credit manager to loosen credit limit to specific customers on account of individual profits and therefore jeopardize the receivables collection.

2) REVENUE RECOGNITION

The revenue recognition function could be automatically performed by the system instead of always relying on manual adjustments so as to establish a stronger control to avoid manipulation of window dressing for revenue involved. Furthermore, the "advance pricing functionality" could strengthen the preventive control over inappropriate revenue recognition fraud that the revenue is incorrectly treated as "realized" or "earned" but actually it should not be since the seller's price to the buyer has not yet been fixed or determinable.

What's even better, a prompt linkage could be bridged among the planning team, finance, and top management concerned to ensure a credible customer is selected and to avoid the potential risk of bad debts incurred by a loose credit limit.

3) BAD DEBTS ALLOWANCE

A systematic way for bad debts allowance could be provided to reduce the manual errors possibly committed by AR accountant when evaluating and calculating aging receivables by detail. It strengthens the preventive control over aging receivables management and detects the potential risk of bad debts incurred with an earlier system alert to related customers.

B. CONCLUSION AND CONTRIBUTION

In terms of SOX compliance, there exist a good deal of deficiencies over internal controls supported by the current financial modules and potential manual frauds which may jeopardize the quality of financial reporting and lead to serious harmful consequences to the company as a whole.

We design and analyze the related financial system to carry out the intelligent property of the financial environments, base on the collection and processing of financial data.

Once there is an early warning in the financial system, the enhanced system our proposed could give a quick response, and bridge a positive linkage about the planning department, finance department, and top managers, which could avoid potential exposure to bad debts. This system guarantees that the credible customers are selected, and avoid the potential risk of bad debts incurred by the loose credit limit. It strengthens the preventive control over aging receivables management and detects the potential risk of bad debts in the earlier system alert.

C. FUTURE WORK

The case company used to perform a manual review of the availability and qualification of shipping documentation for further revenue recognition and Cost of goods sold(COGS) adjustment.

A "deferral revenue recognition" functionality is proposed to be used for the entity (branch or subsidiary) whose trade sales mode is unsophisticated to appropriately evaluate the lead time of shipments and avoid manipulation of price modification for revenue involved.

Moreover, an "advance pricing" enhanced functionality is suggested to monitor the credit memo issued by customers so as to evaluate and analyze the price variance among buyer's PO price, seller's advance price, and seller's final price after negotiation or discounts.

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