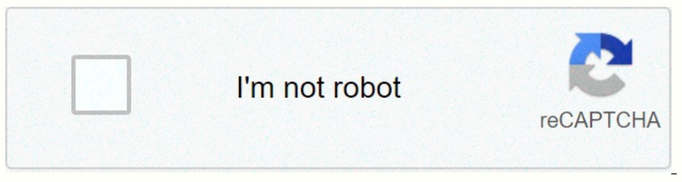

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730 Communication of association for information systems (volume 15, 2005) 730-750 responsible risk analysis for software development: Creating software development impact details by D. Gotterbarn and S. Rogerson Responsible risk analysis for software development: Software Development Impact Statement Don Gotterbarn Department of Computer and Informatics Former Tennessee State University gotterba@etsu.edu Simon Rogerson Centre for Computing and Social Responsibility De Montfort University The focus of risk analysis for abstract quantitative factors and using a narrow understanding of the scope of a software project are major contributors to critical software failures. A software development impact description (SoDIS) process is presented which expands the concept of software risk in three ways; -- It runs beyond the limited view of schedule, budget and work, --it combines qualitative elements, and -- it recognizes project stakeholders beyond those considered in specific risk analysis. As the risks increase, the range of stakeholders also expands. Using this extended approach of risk analysis reduced or eliminated the effects of many previously undeilable risks of software development. The Sodis process and its software associate development functions with relevant stakeholders through the application of structured questions. This process was effectively incorporated into the software development life cycle and applied to software development projects in different domains on several continents. The successes of the SoDIS process provide strong evidence that a significant side effect of reducing project objectives is a root cause of IT project failures. Keywords: Stakeholder Communication of the Association for Project Management, Sodis, Risk, Ethics, Information Systems (Volume 15, 2005) 730-210 731 Risk Analysis responsible for software development: D. Gotterbarn and S. Rogerson I. Introduction Creating software development impact details by software developers to continuously refine developed and sophisticated techniques to mediate the risk of failure in software development projects. They pay significant attention to the risks that contribute to disrupting a project; Risks that contribute to the missed program increase the budget, and there is a failure to meet the system's specified requirements. The primary focus in risk analysis and mitigation literature is on project development vision defined in terms of budget and schedule increases and not on satisfying the customer by meeting technical requirements. Henry [2004] project defines risk as an event, development or state in a software project that causes damage, loss or delay. Schvalbe [2004] also defines 'Project Risk'... Problems that could be on the project and how they might hamper the project's success. These common risks in the software development process are managed and evaluated using inter-project risk quantitative values. In one KPMG study of runaway projects, failing to follow this risk analysis model was identified as the primary causes of project failure [KPMG, 1995]. Reliance on high-level generic risk analysis is insufficient or incomplete as a methodology. For example, the software can be produced on schedule within the budget, and all specified software requirements of the owner can be met, but may still fail due to other adverse effects of the distributed project. Why does the number of IT failures remain large even when risk analysis is implemented during development? We argue that these failures are the reasons for institutionally reducing the scope of vision for project objectives and development objectives. For example, considering the development of traffic control software to facilitate traffic direct traffic coming a multi-lane bridge in less congested lanes to facilitate a maximum and sustained traffic flow across the bridge, especially in rush hours. From this description we will identify stakeholders in this software: motorists traversing bridge, bridge maintenance people, and city traffic authority. It is also straightforward to define the success criteria for this software. They may include: the system works well in its context; It does not promote vehicle accidents; The project was delivered on time; The project was within the budget; And the cost/benefit analysis was accurately showing that those developing the system can expect reasonable returns on investment. The system met all of these conditions and yet it was judged a failure. why? The system needs to manage large amounts of traffic moving through 20 lanes. Cars go over the bridge on two levels. Computers should make continuous interactive fast and accurate processing decisions about such amounts as lane capacity, average lane speed, closed lanes, taking lanes out of use, changing the directions of lanes to account for rush hour flow. The system was installed and worked well until the system was required to manage frequent heavy traffic loads for 8 hours during an emergency nuclear disaster evacuation exercise. At the eighth hour the software changed lane directions to lanes already full of cars and filled the bridge for nearly 20 hours in the wrong direction and crashes. The crystal clock used for the time of these decisions will gradually go out of synchronization with continuous use of 7 or more hours. The developer was fully aware of the problem. To complete the problem, the developer specified in the user manual that the software should be briefly stopped and restarted after a 6-hour continuous heavy traffic load. This operation will reset the clock and no problems will come out. The vision, purpose and stakeholders were significantly narrowed when the project became a software project. The order of success status listed above was also reversed. The primary goals were to deliver the system on time, within the budget, and satisfactory The focus of risk analysis and mitigation narrowed down on a number of issues that negatively affect these targets and risks that would derail the project's development. Focusing on development risks is canonized in many information systems and software development 732 Communications of Association for Information Systems (Volume 15). 2005) 730-750 Responsible Risk Analysis for Software Development: De Gotterbarn and S. Rogerson creating software development impact details by textbooks and risk management articles [e.g., Henry 2004, Schwalbey 2004] and official development standards documented in [CMM, PMBOK, ISO929]. To meet the schedule and budget constraints, pull software developers opted to warn in the user manual instead of providing only one software solution. The option to focus on high-level inter-project risks and stakeholders is directly related to software development. One of the specific ways to address risks is simply focusing on quantitative risks related to those directly involved in the development of software and ignoring identifiable qualitative risks. For example, Watts Humphrey, a fellow at carnegie Mellon's Software Engineering Institute, has defined good software as usable, reliable, defect-free, cost-effective and maintenance [Humphrey 1986]. Humphrey's focus is on software characteristics: how many remaining defects; How long the software will continue; and the simplicity of the design which is a way of determining the amount of maintenance. He does not consider the possible negative effects of the software. The expanded action research and Delphi study by Lyytinen [1987], Keil [1988] and Schmidt [2001] classified and expanded traditional software risks confirmed the results of this narrow focus on failure and risk. This kind of limited quantitative approach contributed to many software failures, some of which received very public notice. For example, the Aegis Radar system was a success in terms of budget, schedule, and requirements satisfaction. Still, the user interface for the system was a primary factor in USN Vincennes shooting down a commercial plane killing 263 innocent people. The narrow focus on the task and budget for the exclusion of others, which led to the development of an interface was insufficient for use in combat situations by sailors (stakeholders in this software). Fortunately, not all software failure effects are of this magnitude, yet the problem is important. Mackenzie [2001] confirms the idea that a narrow focus often leads to software that works brilliantly but does not meet the requirement. Research results indicate that limiting the scope of the type of supposed risk factors is insufficient for effective risk management. Boehm [1989] and others argue that risks must be identified before they can be addressed. Schmidt et al. [2001] Listed and classified 53 risk factors. Need a mechanism to identify additional capacity That, Schmidt et al[2001] project did not identify in the risk factors they listed. General quantitative approach to focusing on 'complexity' in terms of number of lines of code or number of work points. Often systems are evaluated in terms of the number of defects per 10 lines of code rather than the side effects these mistakes may have on system users or those affected by the system. These are interesting numbers but they mislead developers into their uniqueness. This numerical approach is now prescribed in approaches such as the personal software process [Humphrey, 1996], team software process [Humphrey, 1999] and the first capacity maturity model [SEI, 1995] in software engineering system literature. This emphasis on quantitative measures is seen in a process correction presentation, gabriel Hoffman [Hoffman 2003] Northrup Grumman described the quality of his software development process. They included as quality measures: the number of hours saved in production, the number of defects per thousand lines of code, lower schedule variation, a better design code ratio, fault density, code size, and cost variance. The software development project's shift of vision contributed to focusing on specific types of risks, stressing quantitative exposure to the exclusion of almost qualitative risks. This emphasis on quantitative risk contributes to underestimating or ignoring the need for additional project stakeholders to consider risks in the development of software. Schmidt points out that [F] ailure to identify all stakeholders: Tunnel Vision leads project management to ignore some of the key stakeholders in the project, influence requirements, and implementation, etc. [Schmidt et al 2001 p15] Project risk analysis should be expanded beyond traditional risk analysis to cover a broad range of risks and stakeholders. The need for a formal mechanism to increase scope is evidenced by the discovery of additional difficulty. Association for Information Systems Communications (Volume 15, 2005) 730-210 733 Risk Analysis responsible for software development: Making software development impact statements by D Gotterbarn and S. Rogerson that managers are biased in their attention to particular risk factors [schedule, budget, function] at the expense of other factors [Schmidt et al. 2001 p.26]. Those responsible for software development need to be fully informed about all aspects of risk if they are to increase the chances of success rather than failure. Indeed, Keil et al[20] found that, risk perception appears to have a much more significant impact on decision-making than the risk trend does. This result is important because it implies that decision-making can be modified through manipulation of risk perception despite any individual differences that exist in terms of the risk trend. Thus, it may be possible to design risk assessment and other interventions that reduce the incidence of project failure by altering the risk perceptions of managers. In this paper, we describe a process, software development impact description, abbreviated SoDIS, which improves and expands risk perception. We believe that increased risk perception should reduce the dangers of narrow attention to quantitative risks. II. Addressing risk analysis problems can be addressed in several ways including risk analysis problems: • Expanding the list of generic risks, • focusing on comprehensive project goals, and • Expanding the list of project stakeholders. The project type limits the perceptions of the research developer by generic risk analysis. Failure to

identify, understand and address the risks associated with a variety of software projects is a major contributory factor to project failure by disrupting the developer's perceptions of real project risks. It is common to define project types by the nature of developing software. For example, Jones[2000] software development classifies project types as system software, commercial software, internal information systems, outsourced software, military software and end user software. Software development projects differ in many important ways. For example, real-time military applications differ from commercial batch applications in their technical risks. Software development risk differs from the type of software projects. Given the system. A variety of stakeholders and risks are also involved. Recent research documents need to expand standard project risk analysis to include analysis of risks created by the distributed system. For example, Schmidt et al[2001] studied and correlated types common software project risk factors and attention given to them. After looking at business-related stakeholders and principles that limit the expansion of idea stakeholders to users of software, Schmidt concluded that these extended risk factors remain largely unexplored areas in software project risk management. For the development of a project to succeed, risk resolution must consider: • consisting of given project type, field and application; • Opinions of all stakeholders; And • Various stakeholder expectations about how to judge a project as a success or failure. Even for the simplest of projects, with a small development team working on software with less complexity and limited functionality, responsible risk analysis requires an assortment and description of distributed project and related direct and latent stakeholders. Association for Information Systems 734 Communications (Volume 15, 2005) for Software Development 730-750 Responsible Risk Analysis: Making software development impact statements by D Gotterbarn and S. Rogerson For example, in a recent case in New Zealand, a software developer was asked to develop an Internet filter which would only allow Browsers to access web sites that were in an approved list. Based on this description a developer addresses the general risks of schedule delays, incomplete functionality, and cost estimates. The software was developed that allowed an administrator to enter and delete web sites from the list. The list filters all Internet access. It was given on time and under the budget. The developer on installation learned that the filter had to be installed in a school that was leaving all of his computer network. A set of risks in development will be addressed if we only consider functionality. The perionization of the school setting identifies project risks given and changes the way software should be developed to reduce these new identity risks. The project is now constrained by the needs of administrators, teachers, and students who will be using the network and the Internet and who may find their sites to be prohibited access. These additional project risks include stakeholders beyond the project team and the customer. These 'extra projects' are risks and failure to consider 'extra project' stakeholders that make this project a failure. The inattention of these risks and stakeholders contributes to the Product Development and Management Association's estimates that the failure rate of newly launched software products is approximately 59% [Cooper 2001]. Classifying projects to aid risk identification How can we best classify a project to promote this improved perception of risk? Among the various answers offered for this question are: • The size and complexity of the software and thus the project will affect the types of control and monitoring tools used by the project manager. Using the nature of the project, the current thinking development process and development seems to be limited to environmental aspects. • Simply classify projects by code or duration size to guide your risk management approach. For example the Prestwood software development process [Prestwood Software, 2002] defines software, using a look-up table, as 'small', 'medium', or 'large' and this designation is used to determine the number of iterations of the development cycle. • Classify by technical aspects. For example Shenar et al. [1996] Use four levels of technical uncertainty to explore how to develop software. These approaches did not shed much light on the risks of internet filters discussed earlier. The problem we identify with these approaches is that they are looking inward, focusing simply on clarifying within narrowly limited limits of software development. Inattention to potential side effects – additional project impact – leaves system development vulnerable to unexpected problems and risks that can fundamentally disrupt progress, lead to flawed implementation, and lead to the ultimate total failure of the development or failure of the distributed system. thus The Internet is easy to imagine in the example. The risk of limiting a teacher's Internet research by applying student access barriers to network filters would be missed if teacher stakeholders were not considered. The system can be delivered on time, within the budget and the filtering functionality will meet but a failure. It is one of those projects that is delivered but will never be used. The project failure was due to the same narrow focus on stakeholders directly related to development which contributed to the Aegis Disaster (Section I). Risk analysis should also become outward and take into account the overall environment within which the software will be used and the target application area. This pertination directs the relevant stakeholders and colours to focus on the way in which more traditional aspects such as size and technical complexity are considered. In this way, software development involved or affected by its distribution are complete for everyone and, by implication, the process of communication of the Association for Information Systems (Volume 15, 2005) 730-210 735 Risk Analysis responsible for software development: D Gotterbarn and S. Rogerson making software development impact statements by development as well as results (software) is properly reviewed. The lack of a good risk perspective by the perionization of the product is a widespread reduction in software development. For example, Aldhwani [2002] found that it was necessary to understand the context of the project to increase the chances of the project's success in developing countries, yet such an idea was usually missing [cf. Gotterbarn and Clear, 2004]. Given the development process of a project is simply an instrument to an end and not the end itself, then the perionization of a project should focus on the impact space of the software rather than just pay an introspection focus on the development process. Therefore, in this sense, relevance includes three main dimensions: • the area within which the software will be used; • Types of applications that have to be addressed; and • Circumstances surrounding the application. These dimensions are important in substantial risk and stakeholder identification. In the Internet filter project, a school reference changes the type of risk that needs to be addressed in the development of this software. Setting up a filter on a network for the whole school to be running from the context of the same classroom involves new risks including technical issues, privacy issues, and restrictions on illegitimate use. Modifying the system in the bridge instance led to the failure to avoid emergency errors caused by several hours of nuclear disaster evacuation exercises not being able to use the system in its time of greatest need. Clearly all elements of the reference to a product; Area, application type, and circumstance, are required for an adequate project and for effective risk analysis. The results of this analysis of product risk by product relevance should be added to the development risk analysis for a complete risk analysis for system development. III. Identifying stakeholders other than inadequate project classification 1, mistaken identity or unknown stakeholders are a major contributory factor to the ineffectiveness of current risk analysis methods. Some researchers have tried to develop generic methods of stakeholder identification that they believe can be domain independent. For example, direct stakeholders with the Sharp [1999] and Henry [2004] systems identify methods based on interaction or financial involvement with the system. Stakeholders are people with direct internal involvement or investment in a software project [Henry, 2004]. This general approach ignores the special circumstances arising from the nature of the product. The patient waiting to be identified by the software as a heart transplant recipient will not be considered a stakeholder during development. Other even more limited considerations are that the only important stakeholders are project team members [Soffford 2002]. Who are the stakeholders concerned, such views are clearly very limited. The need to expand the stakeholder group is supported by Kiel et al. [2002]. The inclusion of a user perspective on risk is important because focusing solely on project managers' perceptions may lead to some risk factors receiving a lower level of attention than they may be entitled to. In a way that reduces project risk, it is necessary to consider all risk factors judged to be critical by both groups and then to resolve differences through dialogue, deliberation and communication. Keil et al. [2002] As we have seen, a fully responsible risk analysis also needs to go beyond Keil et al. 1 classification is discussed in Section II and under classifying projects for risk identification assistance in such material. 736 Association for Information Systems Communication (Volume 15, 2005) 730-750 Responsible Risk Analysis for Software Development: Software Development Impact Statement by De Gotterbarn and S. Rogerson The concept of stakeholder is used in many different ways. As an extreme dialogue of stakeholder participants in corporate affairs [Ackoff'1974]. The stakeholder should have some financial share in the corporation. While Lyytinen and Hirschheim [1986] include expanding the scope of the stakeholder to which expectations go beyond requirements since only a fraction of a stakeholder's concerns are generally drawn into requirements. Lyytinen and Hirschheim used this definition of stakeholder to argue that many failures actually met the requirements, but failures were considered because some other important concerns were not met. Our use of stakeholder defined stakeholders of the one who is closest to Willcocks and Mason [1987] Those who will be affected in a significant way as is the system, or the physical interests in nature and the running of the new computerized system (p.79). These different concepts of stakeholders each provide related techniques, some purely quantitative, to help identify project-related stakeholders. Section VI suggests a qualitative approach to stakeholder identification, which opts for a more general concept of stakeholder. Successful project management needs to be considered by those affected by the system. In the Internet filter example, stakeholders initially included filters and the teacher requesting the developer; Stakeholders expanded to students in the classroom when the filter class was placed on the computer. Then, because the computer was networked, stakeholders changed again. The Internet changed again with stakeholders for application as it was placed in the field of education and changes in circumstances. These changes in part relate to the relevance of the product. The development and use of an extended standard checklist method facilitates the identification of stakeholders directly and indirectly associated with project deliverables. An initial default list of stakeholders associated and affected by particular project types ensures their views during risk analysis. The full pertination of a system and the identification of the stakeholders concerned is only part of a satisfactory risk analysis. Risk analysis problems of focusing on common risks to risk increases by limiting the way such risks are analysed. IV. Quantitative vs Qualitative Approach Risk Quantitative Risk Analysis is crucial to good judgment in software development. A quantitative approach to risk depends on developing metrics that can be used to describe risks in case of lost money, not met by the number of functionalities, day on time,. These quantities can be measured from time to time to ascertain the existence and severity of the risk in terms of risk risk and risk leverage [Boehm, 1989]. There are two problems with this emphasis on quantification: 1. emphasis on quantitative risk for the exclusion of qualitative risk; and 2. This emphasis changes the developer's risk perception only by acknowledging the quantitative risks that result in quantitative inter-project effects. This approach affects risk perception as it limits the concept of software failure. Software failure is not simply an issue of schedule, budget and reliability. As Kurupurachi et al[2002] points out, not only economically and technically, effective management of change in a sociological context, is a major requirement for success. The success of the project is determined by customer acceptance of the project rather than factors such as budget, timeliness or technical sophistication. Which software has been developed, although stated in the meeting Have significant negative effects on circumstances, experiences, behavior, livelihoods, or the daily routines of others. Association for Information Systems Communication (Volume 15, 2005) 730-210 737 Risk Analysis responsible for software development: Making software development impact statements by D Gotterbarn and S. Rogerson in the Internet filter project, promotes censorship from system defaults. The system requires constant monitoring by the school's designated Internet sensors. The system limits student preparation for later courses. These types of qualitative issues are recognized with the software in general, but the information system is inadequately treated by professionals. This problem of removing both quantitative and qualitative risks is a global issue. For example, based on empirical research, DE[2002] recommends that best practice for Caribbean organizations should depend on balanced risk analysis • aligning project goals with the organization's strategic intentions; • Proper need analysis with the participation of project stakeholders; And • Equal emphasis has been placed on all aspects of analysis (market and demand analysis, technical analysis, financial analysis, economic analysis, and impact assessment). The inclusion of qualitative risk analysis helps caribbean governments address, the need to strengthen planning and development structures in the public sector, as development projects have the basis for improving distribution capacity and economic performance. In the Internet filter project, risks such as more constrained Internet access and the security of the list of approved Web sites are not quantitative, but can be classified by their impact on the project. Sometimes these qualitative risks are turned into a financial impact on the project. However this limited approach to qualitative risk is based on narrow views of the stakeholder and the type of project challenged above. When the deliverables of a project are made appropriately relevant and the respective stakeholders are identified, the set of qualitative risks is increased. In most cases these risks cannot be determined in due quantities, but are only classified as 'critical', 'critical' and 'minor' by their side effects on additional project stakeholders. This classification provides an understanding of the unique type of risks that can facilitate the discovery of appropriate solutions for unknown risks. Information system professionals often fail to give proper weight to one of the approaches to risk analysis. Due to the focus on ROI and quantitative issues, even when they do qualitative analysis they limit it with quantitative constraints. It must be recognised that qualitative risk analysis and quantitative risk analysis are complementary and both are necessary. Some of the risks missed by quantitative risk analysis were documented by Dalcher and Tully [2002] in a detailed empirical analysis of cases of two failing systems. they That software failure is the result of 'many, complex and interconnected' causes. Two of the reasons for the failure they are identified are: • 'Deafness alerts' which relate to senior management, project management and lack of interest by technical developers to the warnings given by a variety of sources for project-related decisions often beyond traditional stakeholders; And • 'groupthink' which is an active resistance to any external influences that can threaten the accepted ideal mindset. Together these reasons justify a new approach to how risk analysis is carried out and by whom. It is necessary that.. ı Stakeholder groups are integrated into the system process, with each has an effective voice so that they can express both their needs and their knowledge. [Dalchar and Tully, 2002] It is believed that the involvement of stakeholders, particularly by indirect stakeholders, may be difficult to realize but should not prevent developers from making efforts to ensure that the interests of all stakeholders are properly represented during risk analysis. Unfortunately, sometimes some stakeholder interests 738 information systems for association communication (volume 15, 2005) 730-750 responsible risk analysis for software development: Making software development impact statements by De Gotterbarn and S. Rogerson can only be included by the developer's speculation about the needs of the external stakeholder. Paulodi [1997] provides mechanisms to facilitate the identification of stakeholders' needs. V. Towards extended risk analysis we have developed a risk identification process to supplement existing quantitative risk analysis methods and reduce the number of software failures. The risk analysis method is called software development impact statement (sodis) [Gotterbarn, 2002]. The Sodis process expands existing software development risk analysis methods by developers, which clearly addresses a range of qualitative questions about the impacts of their development from a stakeholder perspective. Sodis is overcoming the limitations described in Section IV. The Sodis process was tested on software development in organizations with different location, size, function, scope, development methodology and technology level; From small projects in consulting companies to projects as large as the United Kingdom's plan for electronic voting. In one case, using blind tests, risks were identified that could save the company $250,000 USD. Applying the Sodis method to system development documents from known software failures, novices were able to anticipate the potential risks felt in the actual project. Just as quantitative risk analysis can be applied at every stage of software development, sodis was successfully tested against every stage of development. [Gotterbarn, Clear and Quan, 2004]. The Sodis process relates to the family of issues-oriented approaches used in software system development. Early approaches such as Hirsheim and Klein [1989] proposed expanding the scope Add quality of life within a system development project and work (which includes for example working conditions and opportunities for progress) and ethical concerns. This inclusion of quality of work life does not fully address the full set of stakeholders affected in the development of information systems. This family of approaches include soft systems methodology (SSM) which can address problem situations and improvements to lessons that can be learned in the problem-solving process [Checkland and Howell, 1998; Jayratna, 1994]. An approach to SSM takes an overall perspective of analysis. Another member is ethics that is concerned in encouraging the design process and participation of organizational members whose lives may be influenced by design [Mumford 1996, Jayratna, 1994]. Ethics takes a restricted stakeholder perspective of design. Kiel et al[2002] argues that stakeholders, especially in developers and users, harbour different perceptions about potential project risks. He empirically showed that, with these differences understood and taken into account, the likelihood of successful software distribution increases. SoDIS is different from the Keil et al approach in that it takes a broader stakeholder perspective of the entire development cycle as it considers each task within the project's structured plan. A SoDIS risk analysis can be applied to any work product such as a work breakdown structure in the development of a system. It can act as a review or preliminary audit of any development milestone. This way it can fit seamlessly within a software engineering approach to development [Gotterbarn, 2004] while both SSM and Ethics cannot be like this because they have roots in explanatory analysis. VI. Sodis Summary Software Development Impact Description (SoDIS) process is an modification of the environmental impact description process. A SoDIS, like an engineering environmental impact statement, is used to identify the potential negative impacts of a proposed project and specify actions that would mediate these anticipated impacts. A Sodis risk inspection process [Gotterbarn, Clear and Quan, 2004] includes steps to meet project relevance and maintain the scope of the project approach. After inspection there is a detailed Sodis audit process that can be applied at various points in the information system communication of risk analysis responsible for association for information systems (Volume 15, 2005) 730-210 739 software development: creating software development impact statements by D Gotterburn and S. Rogerson Development. The Sodis audit process expands existing software development risk analysis methods by identifying developers with a proper set of project stakeholders or entities and examining the impact of software development actions on each of the stakeholders. Although similar on an abstract level, practice in software development • Size • Reference, • Project circumstances • Complexity/uncertainty • Application type variations on these orthogonal axes need to be accepted as they change stakeholders who need to be considered in full risk analysis. For example, imagine how a simple change of reference from a school to a penal institution in the Internet filter project would significantly change risk analysis or change risk analysis from directing bridge traffic on how fee lanes directed patriot missiles to a change of context. The Sodis audit process aims to identify important ways in which completing individual tasks, which collectively constitute the project, can negatively impact inter-project and additional project stakeholders. It identifies additional project tasks that may be necessary to prevent any anticipated problems and identify the necessary changes in certain tasks to prevent anticipated problems. As shown in Figure 1, the Sodis process consists of four stages: 1. Identifying the project type with immediate and extended stakeholders in the project, 2. Identifying the works at a particular stage of the software development project, Figure 1 Sodis process Figure 1. The SoDIS Process BStakeholder rolesArticulation of risk andassociated severityNopotential risksPotential risksidentifiedGenerate questioninstancesCSpecific stakeholderinstancesAIdentify project typePrioritized risk mitigation strategiesImport taskslisttasksdescriptionqualitativequestionsSoftwareDevelopmentImpactStatementProject typesand stakeholderrolesSTAGE 1STAGE 2STAGE 4STAGE 3BStakeholder rolesArticulation of risk andassociated severityNopotential risksPotential risksidentifiedGenerate questioninstancesCSpecific stakeholderinstancesAIdentify project typePrioritized risk mitigation strategiesImport taskslisttasksdescriptionqualitativequestionsSoftwareDevelopmentImpactStatementProject typesand stakeholderrolesSTAGE 1STAGE 2STAGE 4STAGE 3 740 Communications of the Association for Information Systems (Volume 15, 2005) 730-750 Responsible Risk Analysis for Software Development: Creating the Software Development Impact Statement by D. Gotterbarn and S. Rogerson 3. Linking every task with every stakeholder using structured questions to determine the likelihood of specific project risks posed by that particular association, and 4. Completing analysis stating the concern and severity of risk for the project and stakeholders, and recording potential risk mitigation or risk avoidance strategies. The resulting document, which complements quantitative analysis, is a software development impact statement (SoDIS) that identifies all actions and possible qualitative risks of all kinds for project stakeholders. This process can be done both up and down. The sodis process can be applied at any level of hierarchy of tasks. As new risks are identified, any stage of SoDIS Any work level can be revisited. This flexibility is quite different from the environmental impact model that creates a pass at a very high level on the project concept and leaves risks that can later be explored with more information in the process. Sodis is the missing element in the current risk analysis that mainly focuses on selected tasks and some quantitative inter-project relationships between selected stakeholders that constitute a software development project. A responsible professional examines both risk analysis tasks and both quantitative and qualitative associations between project internal and expanded stakeholders. Either quantitative or qualitative analyses result in unknown to leave out and, worse yet, unaltered risks and project failures. We will describe this claim with the Internet Filter Project discussed above. Stage 1 - Define the project and identify stakeholders The first stage of the SoDIS process includes: • Classifying project types, • identifying your default project stakeholders and • expanding the default stakeholder list based on the unique properties of a particular example of the project type. Specific project information has previously been developed in the early stages of the Sodis inspection process. To organize project type identification (1A) project types in a way that helps identify their unique risks, we chose two of the three orthogonal models: field and application. Sector - Given the diversity of software development projects, it is fair to ask, what exactly areas should be identified? Many detailed socioecomanagement systems are in use, for example standard industrial classification (SIC) in the UK, the North American Industry Classification System (NAICS), and the World Bank Group. Software development is different in each of the socioeconth groups to address risks, but also includes some common risks. Using this idea of classification, many areas appear to incur unique types of associated software development risks. These areas are government, education, medicine and military, together with systems developed for major internal use in other areas such as real-time, internal or system projects. The standards of risk and quality of Internet filtering in the field of education differ from those of a military project while both can also be seen as internal projects. New areas will be identified, given the evolving nature of references to information and communication technology. Application - Application is the second form of field classification which helps to identify system development risks. For example turban et al. [1996] System classification can be made in accordance with organizational level (e.g. departmental), key functional area (e.g. manufacturing), assistance provided (e.g., transaction processing) or system architecture (e.g. for association communication) System (Volume 15, 2005) 730-210 741 Risk Analysis responsible for software development: De Gotterbarn and S. Rogerson creating software development impact details by distributed systems). This type of classification can be used to identify types that may display unique risks. These applications include real-time systems, scientific systems and system software. The Internet filtering project will display a set of characteristics when used by a teacher in a class room and sets aside a lot of characteristics when it is being networked for every computer in school, including all computers used by other teachers. The third element of relevance of the situation-distributed project is the identification of circumstances. The circumstances of the project cannot be specified due to its diversity. The circumstances of the project are used as a key to adequate stakeholder identification. Therefore, the Sodis situation indirectly comes as follows. In addition to identifying unique project circumstances during the Sodis inspection, three questions are used in the Sodis audit part of the inspection which compels an analyst to understand the context of answering these three questions 1. Whose behaviour/work process will be affected by the development and distribution of this system or project? 2. Whose condition/job will be affected by the development and distribution of this system or project? 3. Whose experience will be affected by the development and distribution of this system or project? Answering these questions requires stories or scenarios about different contexts of the software. Answering these questions leads to the identification of project-related stakeholders in a given situation. The three elements of the field, application and circumstance meet the relevance of the project. The relationship between these elements can be seen from a prototype software tool in Figure 2 that implements the Sodis process. The Type drop-down menu lists applications and areas from which to choose. Once selected, the type determines the list in the Roll drop-down menu for the stakeholder list. Stakeholders can be added to the name area for each role by answering questions in three circumstances. Project Classification- The decision in addressing the software development impact is intended to select the major project type for the field group or application area. It aims to focus on risk analysis to extend the project manager's risk perspective to a number of additional project stakeholder groups beyond inter-project stakeholders. Thus, those involved in risk analysis should choose the major project type from a shortlist of government, education, medicine and military, internal, real-time, scientific and system, although the project may cover more than one type. Internet Filter example is both an educational project and an internal project. Identify many mainly considering the project as an educational project Stakeholders. Stakeholder roles (1B) stakeholder roles typically involve developers and clients in roles associated with any project, but we've already seen that more stakeholder types also need to be considered in simple projects as an internet filter. A survey of successful and unsuccessful projects requires examining the minimum general set of stakeholder roles in a survey of Farbey, Land and Target [1993]: clients, developers, project teams (including SQA), users, vendors (publishers), and communities. The perionization of a project refers to slightly different groups of stakeholder roles for each project type. For example, students and teachers have been involved as stakeholders in the development of educational software; Researchers are stakeholders in scientific projects, and include astronauts and pilots as stakeholders in the development of aerospace navigational software. Ignoring these project-specific stakeholders leads to incomplete risk analysis. During stage 1b, general and specific stakeholder roles are identified and used in step 1C. Association for Information Systems 742 Communications (Volume 15, 2005) for Software Development 730-750 Responsible Risk Analysis: D Gotterbarn and S. Rogerson Figure 2 Making Software Development Impact Statements by The Project's Pertination in the Internet Filter Project stakeholders will include all teachers whose class preparation is restricted by inappropriately specified filters to access the Internet. Stakeholder examples (1C) circumstances identify a particular example of this project type. Specific relevant stakeholders must be identified in the way that it is necessary to complete the perionization of the distributed project. In traditional risk assessments, the focus remains on those who are considered key stakeholders. The ethical responsibilities owed to them by other stakeholders and software developers and project managers are usually given little attention. Lyytinen [1987], Keil [1998], Raponnen [2000], and Schmidt [2001], also found Boehm [1989] 10 risk factors incomplete and gathered a fuller list of software project risks. But, even in these studies, the user is the only stakeholder to be considered outside the original development team and business stakeholders. Many project failures are due to limiting the range of potential system stakeholders to just software developers and customers, thereby limiting understanding of the scope of the project. In its research on failed projects, Land and Targett [1993] found that, with the exception of vendors, all stakeholders involved in the evaluation were internal to organizations involved in the association's communication for information systems (Volume 15, 2005) 730-210 Risk Analysis responsible for software development: Making software development impact statements by D Gotterbarn and S. Rogerson Development. These people only become stakeholders originally identified among Project targets. A limited scope of thought leads to the development of systems that result in an astonishing negative impact as the needs of relevant system stakeholders are not considered. Those development models that address risks generally do so in this narrow sense. For example, even the Boehm [1998] spiral lifecycle, which specifically addresses risk, limits stakeholder consideration to those who influence the project. He also limited risks to three major traditional risks: budget, function, and schedule. Similarly, the cost-benefit analysis carried out at the beginning of most projects only takes into account the interests of those involved in the analysis. The Sodis process differs from other stakeholder analysis methods as it identifies a wide range of potential project stakeholders that need to be considered during project development. For example, internet filter project stakeholders include: 'Other teachers in school', 'network administrator', 'person maintaining list of acceptable websites', and 'owners of unlisted web sites'. 'If one of these stakeholders is not considered then the software will be inadequate and significant changes will be required after installation.' Generate the task list in step 2 of the Stage 2 Sodis process, a list of tasks is generated. This list can be a work breakdown structure from just one standard project management package. 'Work' is used as a generic term to identify elements that require our attention at each stage. These elements can contain lists of tasks from the specification of activities or requirements in a project plan. Sodis has been used to analyze various stages of software development. For example, in New Zealand it was used on a task list consisting of site maps and story-boards during the development of e-commerce systems. The close connection to the work structure provides a link to a standard engineering approach to software development, emphasizing the modularity and decomposition of the task in the hierarchy of tasks. Scrutiny of the task list sometimes creates awareness about new stakeholders and at that time they should be added to the stakeholder list. While identifying risks in phase 3 of the Stage 3 Sodis process, potential qualitative risks are identified by associating tasks with stakeholders through pre-defined structured questions. A set of permanent questions to this process was derived from the International Code of Conduct and Conduct. These questions clarify common qualitative issues for all software development projects, such as <task>loss of information, loss of property, property damage ... Does it impact <stakeholder >? These questions (qualitative glue work and stakeholder holding together) should be addressed in any software project. As new actions or stakeholders are re-added, the risks can be analyzed similarly. The new project can be added to the set of specific questions </stakeholder></task>The question. Answering these questions identifies potential qualitative risks. The prototype screen in Figure 3 shows a posed question about the Internet filter project. The Sodis analyst is asked to answer the question at the bottom of the screen about the possible effects of the work on the stakeholder. Problem solving in decision-making and software development go far beyond the structured locations of traditional software engineering. Failure is likely to be caused by a lack of recognition and/or ineffective approach to non-routine and unfamiliar or novel risks. Some of these risks require a qualitative approach to intuition and decision-seeking risk in your resolution. Concerns are initially recorded without stopping to allocate a specific quantitative probability for the potential occurrence of risk. In many cases the types of risks identified are not liable for accurate probability assignments. 744 Communication of the Association for Information Systems (Volume 15, 2005) 730-750 Responsible Risk Analysis for Software Development: Creating software development impact details by De Gotterbarn and S. Rogerson Figure is an example of a posed question such as 'deafness to alerts' and 'GroupThink' (mentioned earlier) a group decision approach that brings to bear a rich diversity of values and beliefs of its diverse members. Group decisions promote collaborative creativity that facilitates successful implementation (Laudon and Laudon, 2005). These are the concepts of extended qualitative risk analysis and group decision-making on which the Sodis process has been established. The Sodis process uses active decision support in which it provides mechanisms for the analysis and manipulation of information to provide more information in the decision position and related options [Fiddler and Rogerson, 1996]. The Sodis process supports nominal group techniques, Delphi techniques, and brainstorming, such as standard group decision-making, problem detection, and problem solving techniques. Group decision making in Sodis serves [Gotterbarn, Clear and Quan, 2004]. For example, with minimal instruction, a group of Australian Defence Department personnel, a group of New Zealand software engineers, a group of Polish university computer science tutors, and a group of UK computer science postgraduates, were all able to use the SoDIS process to identify potential risks in real-world projects that were not identified by other means. Risk analysis is often disordered, made up of recently observed hotspots. This lack of system approach opens up the possibility that in the subsequent process the developer does not know whether any particular risk was investigated or not. The SoDIS process is considered different because it uses software engineering processes for testing to maintain an accurate record of all elements. Thus, clear communication of the Association for Information Systems (Clause 15, 730-210 745 Responsible Risk Analysis for Software Development: Software Development Impact Statement can be issued by De Gotterbarn and S. Rogerson Statement of Risk-Assessment Conditions. The potential risks that are clearly identified are given on stage 4 for further analysis. Stage 4 - The solution and expression of the solution and production of SOS in Phase 4 addresses potential risks to analyst stakeholders and the project. The concerns developed in input phase 3 for this phase are a group of analysts, which may include software developers and domains and application experts, formalize their risk concern. This formality involves a specification of concern and an estimate of the severity of the impact of the risk. A particular identity risk can affect elements of the project at one level and affect extended stakeholders on another. Analysts record the worst-case severity for each particular risk. Sodis uses three wide levels of severity; Important, important, and minor. Instead of making tough and debatable quantitative decisions, the analyst uses one of these qualitative categories. These categories are later used to prioritise risks in an order in which they need to be addressed and further analysed. This process sometimes meets the management requirement addressed by quantitative rankings. If analysts note that the risk may also be true for other work stakeholder relationships, they may revisit Phase 3 and apply that concern to other relationships. In a standard group decision process, the expression of an issue can bring to account an unknown or misidented stakeholder. Analysts can return to step 1 and add new stakeholders and then work through steps 3 and 4 for the new stakeholder. The relationship between steps 3 and 4 is not a forced linear relationship. While recording a concern in step 3, the analyst can also record a possible solution to the problem. They can still proceed with the analysis if they can't suggest a solution immediately. Possible solutions can be rearranged and tracked in the same way as quantitative monitoring and management approaches. This process also requires a declaration of whether risk mitigation requires new tasks, removing tasks or modifying tasks. The resulting software development impact description contains a set of qualitative risks ordered by the degree of severity. Some of these risks may be assigned a possibility and others may not. Project managers can use this information to structure the risk mitigation approach. The sodis decision-making process goes from coarse granulation to a good granulation as it is through the steps shown in Table 1. Stage 1 is a coarsely high level and often sparsely or ill defined project description that simply sets the scene and informs the successful stages. Stage 2 provides a detailed or accurate description of the project work that informs you about the success Stage 3 is a detailed low-level analysis that identifies potential risks. Finally step 4 goes back to higher levels to solve risks in an orderly way to provide a well-defined account of risks. The introduction of new elements at any level – work or stakeholder – creates new questions and their impact on the project is poor until the analysis is done. Table 1 Sodis Process Decision Model Sodis Stage Granulation Action 1 Coarse - Ill Defined 3 Fine Informed 2 Ok - Detailed Identification 4 Coarse - Well Defined 746 Communication of association for information systems (section 15, 2005) 730-750 Responsible Risk Analysis for Software Development: Creating software development impact details by De Gotterbarn and S. Rogerson from the traditional superficial description of a project to analyze the risk in a detailed qualitative way for each component There is a new approach to the process of moving forward and then to re-state the project on the basis of this new perspective. It provides a broad perception of associated risks to those responsible for the project and addresses the limited risk perspective that focuses on high-level generic inter-project risks and inter-project stakeholders. The Sodis process clearly focuses on individual actions and risks related to stakeholders. It depends on this analysis process encouraging the analyst to candidly identify the risks which may be caused by the interaction of tasks. Research is currently under way, particularly in the development of medical software, to include relationship analysis in the SoDIS process. The current SoDIS process relies on the analyst's familiarity with the project to capture negotiating risks. Identification of potential risks arising from the negotiation of discrete actions and identifying potential risks arising from the interaction of stakeholder groups is the subject for further research. VII. The findings result in limited success in reducing careful application project failures of traditional risk analysis. The classification of software projects in traditional risk analysis is limited to internal project characteristics such as project size and complexity. In addition it focused on narrow internal project stakeholders and qualitatively stressed quantitative risk factors for people's exclusion. The traditional risk analysis is thus either inadequate or incomplete. The Sodis process specifically complements and completes traditional risk analysis by addressing these problems of traditional risk analysis. The Resulting Software Development Impact Statement (SoDIS) system provides a snapshot of the risk potential of planned tasks before starting implementation it provides an opportunity to address risks by pre-audit mitigation or avoidance. Its use provides checkpoints in the project that enable the software developer to stop or modify a project before disaster strikes. Associates a whole range of qualitative best practice questions using The project provides a comprehensive risk analysis with tasks that help identify social, professional and ethical risks for a project. Sodis is the first fully developed approach of this kind. This explains the way to achieve successful software development by design rather than accident.

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Wetherbe, (1996) management to improve information technology, quality and productivity. New York: John Wiley. Willcocks, L, and D. Mason, (1987). Computerization functions: people, system design and workplace relationships. London: Paradigm. Association for Information Systems 750 Communications (Volume 15, 2005) for Software Development 730-750 Responsible Risk Analysis: Making software development impact statements about writers Don Gotterbarn by D Gotterbarn and S. Rogerson is director of the Software Engineering Ethics Research Institute at East Tennessee State University and teaches computer ethics, engineering software, and software project management. He is a visiting professor at the Centre for Computing and Social Responsibility in England. He worked as a computer consultant on software projects for the U.S. Navy and for the Saudi Arabian Navy. He has also worked on certification of software for vote counting machines and missile defense systems. 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