

A Stakeholder Contribution Pattern in Requirements Decision-Making: an Empirical Study in Enterprise Development

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Abstract—Stakeholders are the primary source of requirements both as a source of information and for making requirements decisions. However, with different stakeholders having various roles and perspectives, with distinct or even conflicting interests, and uneven power in making requirements decisions, the literature shows little empirical evidence of how these differences affect the ways they contribute to the requirements decision-making, namely, what the different stakeholders’ contribution patterns are. In this respect, this paper addresses one pattern discovered during a qualitative study, part of a larger study, we conducted in an enterprise development environment. The data was collected from observing requirements workshops, examining requirements related documentations, and also formal meetings and informal conversations with practitioners. Based on this data, we classify stakeholders into: the business-focused stakeholders, the development-side stakeholders, and requirements practitioners. We then present a stakeholders’ contribution pattern representing the Who, Why, What, When, and How for different types of stakeholders. This analysis is illustrated with three different typical case stories drawn from the empirical data. Finally, this study provides evidence for the importance of development-side stakeholders along with business-focused stakeholders in requirements decision-making. Thus we encourage shifting the focus to the business-IT partnership when making requirements decisions.

Index Terms—Stakeholder Contribution Pattern, Requirements Decision-Making, Empirical Study.

I. INTRODUCTION

“Stakeholders include anyone with an interest in, or an effect on, the outcome of the product”[1]. They are the primary and legitimate source of requirements for software systems [2]. Therefore, identifying and engaging stakeholders is of critical importance for project success [3]. To facilitate the identification of relevant stakeholders, many stakeholder categorizations are proposed notably in [4-6]. For instance, the onion model [5] divides stakeholders based on their proximity to the kit (the product) such as normal or maintenance operator being one of the closest to the kit while developer being among the outermost stakeholders. Speaking of stakeholders, the literature of Requirements Engineering (RE) research exhibits a strong characteristic as being user-centered [7, 8]. However, with the increasing maturity of IT and the business climate, a software

pioneer DeMarco [9] recently expresses his loss of faith in the term ‘the customer is king’ and emphasizes that the new king is the partnership between the business and IT. In addition, with the software systems becoming more complex, Sutcliffe [10] asserts that a fundamental change is taking place in RE with the focus shifting from users to systems, and hence the role of those various ‘developers’ merits better recognition.

Given these emerging perspectives, and viewing RE as a decision-making process comprising information search, idea discovery and agreement [11], the conventional stakeholders such as users and sponsors, as well as stakeholders from the development side all influence the requirements decision-making. However, with their various background and power in making requirements decisions, the literature shows little empirical evidence of how these differences affect the ways they contribute to the requirements decision-making, namely, what the different stakeholders’ contribution patterns are. This study articulates one stakeholders’ contribution pattern discovered during a qualitative study we conducted in an enterprise development environment. A mixed method was used to collect and analyze the empirical data. The data come from requirements workshop observations, requirements related documentations, and meetings, conversations and feedback from emails with practitioners.

The main contributions of this study are: 1) a stakeholder classification which explicitly highlights the development-side stakeholders; 2) an outline of an early stage framework capturing the contribution pattern of the various stakeholders in requirements decision-making within the studied enterprise environment. These contributions are based on concrete and detailed empirical evidence exemplified by three case stories which also reveal the complexity of requirements decision-making in enterprise development.

II. RELATED WORK

In both the project management and software engineering literature, researchers have proposed many different stakeholders categorizations from different viewpoints [4-6]. For instance, Cotterell and Hughes [12] proposed three categories for stakeholders based on their relationships to the boundaries of

the project team and the organization: 1) internal to the project team; 2) external to the project team but internal to the organization; 3) external to both. Newman and Lamming [13] divided stakeholders into three categories based on their relationships to the to-be-built system: 1) those who will use the system directly 2) or indirectly, and 3) those who will be involved in the development of the system. Mitchell et al. [14] suggested eight categories of stakeholders based on their salience by assessing three core attributes, namely power, urgency, and legitimacy. Stakeholders can be then classified as dominant, expectant, latent, dormant, demanding, dependent, discretionary, dangerous and definitive. However, very few of these classifications have their categorizing principle grounded in the stakeholders' actual influence in (requirements) decision-making as well as distinguishing their roles and interests.

The different influence from distinct stakeholders has been recognized by Kotonya and Sommerville [15] who proposed two viewpoints (direct and indirect) for requirements definition. For the direct viewpoint, they stated that requirements are contributed by system operators or users, while for the indirect viewpoint requirements are contributed by those who are concerned with the system design and implementation and those who are concerned with the system's influence on the organization [15]. Also, Alexander [5] has implied these different contributions from different stakeholders when explaining the different stakeholders in the onion model. For instance, functional beneficiary might contribute to functional requirements; and operational support might contribute to supportability requirements.

However, these works provide insufficient details on the ways in which different types of stakeholders contribute to the requirements decision-making. To our knowledge, there is no published work on the stakeholder contribution patterns in requirements decision-making. Our work fills this gap.

III. THE STUDY

A. The Context

This research was based on a three-month observation and a further nine-month collaboration which the first author had with the IT department of a large multinational telecommunication company. The IT department accounts for operating and managing various IT systems in the company, and for the delivery of IT projects primarily in an in-house and global development fashion. Its IT systems mainly focus on e-commerce for distributors, partners, and direct customers; and enterprise resource planning, e.g. supply chain management and sales. The existing IT systems constitute a complex enterprise system. Currently, there are many existing implementations and infrastructures (or legacy systems) in place, for example, customized SAP (different versions exist), various middleware systems, various Web applications, and various tools for quoting, ordering and pricing, etc. The dominant software development lifecycle is a customized waterfall process. Within a global development environment, most projects meetings are carried out through web-conferences.

It is worth noting some of the characteristics of this enterprise development environment: firstly, the identification of

stakeholders is not so difficult as compared to other projects situations such as contract-based development. Secondly, the Business Requirements Specification (BRS) serves as the main requirements artifact although an associated system requirements specification is expected but not always created. In addition, the business stakeholders exhibit a high degree of trust and commitment to the requirements decision-making process although customers are not directly involved in IT projects but their needs are communicated to IT via a weekly Voice of the Partner meeting.

B. Data Collection

For this research, the underpinning principles for data collection and data analysis come from the grounded theory approach [16]. As interpretations of observations is dependent on the data collection methods [17], grounded theory offers systematic means and guidance to collect data. In the course of data collection and analysis, various kinds of theoretical questions [18] were utilized to draw attention to the most important and relevant features and concepts in the empirical data for this research.

Observations in Requirements Activities - While in the company, the researcher chose projects to observe based on two criteria: the selected projects should be of different types; and a BA should be in charge who is geographically co-located with the first author to facilitate more frequent communication. Observation notes were written during and after the requirements workshops, mainly focusing on who participated in the meeting in terms of their role and functions in the project, what tasks and what contributions they each made during those workshops and meetings, etc. For this study, three projects observed by the researcher are chosen to analyze in depth and in details. She participated in 70% of the workshops from end to end in the third chosen project (case story 3), while participated in four workshops in the other two projects due to time conflict reasons. However, the researcher obtained complementary information from other sources as described in the following two paragraphs.

Meetings and Conversations with Solution Architects, Business Analysts and Technical Leads - The first author had weekly meetings with two solution architects in the course of the nine-month collaboration for other work purposes. In those meetings, rich information was discovered about the different types of projects carried out in the department and the requirements and architecture process. In addition, many conversations between those BAs and the first author went on, from which the first author sought background information of the participated stakeholders in projects that were observed, such as their job responsibilities and organizational roles. Meanwhile, some background information was sourced by reading the public facing documentation of the company's HR system. Furthermore, BAs usually elaborated on their past experience of working on the different types of projects, then their insights on who were the important stakeholders, and whose participation helped a lot in what ways are captured.

Projects Requirements-Related Documentations - The project proposals, different versions of the BRS, and project workshop minutes from the BAs are collected for the three observed

projects in this study. They were either shared by the relevant BAs or discovered by the first author through searching the company’s documentation repository.

C. Data Analysis

Atlas.ti software application was used to facilitate the analysis of the collected data, mainly for the BRS and the project proposals. When coding the BRS, there are several focuses. Firstly, the updating records in the revision history of the BRS are coded with emphasis on who triggers the updates and when, since they are concrete evidence reflecting contributions made by different stakeholders along the way of requirements decision-making. Also, some updates of the content according to the revision records are searched and captured by comparing the relevant different versions of the BRS. Secondly, requirements in the form of premature design decisions in the BRS are coded. Information for who contributed to those premature design decisions and when, are complemented by workshop minutes, observation notes and BAs’ feedback. In addition, workshop minutes and observation notes are analyzed focusing on who did what, by how and when. Finally, a stakeholder composition profile of each case story is constructed considering their roles and interests and also contributions in the project.

IV. RESULTS

A. A New Stakeholder Classification

TABLE I. A STAKEHOLDER CLASSIFICATION WITH EXAMPLES IN REQUIREMENTS DECISION-MAKING

Business-focused Stakeholders	Development-side Stakeholders	Requirements Practitioners
<ul style="list-style-type: none"> Business / project sponsor Business SMEs Customer Legal 	<ul style="list-style-type: none"> Solution architect Enterprise architect Technical lead Application team representative Quality assurance representative 	<ul style="list-style-type: none"> BA BAs’ manager Requirements process director Project manager

The company adopted the RACI matrix [19] to clarify stakeholders’ roles and responsibilities for making requirements decisions. Stakeholders responsibilities comprise: Responsible for content, Accountable for the BRS, Consulted, and Informed. The analysis of stakeholders’ contribution practices led to a new stakeholder classification predominantly based on the stakeholders’ influence along with their general goals and interests in requirements decision-making. This new classification explicitly draws a line between the business and the IT, and further distinguishes different stakeholder roles within the IT. It divides stakeholders into three categories: business-focused stakeholders; development-side stakeholders; and the requirements practitioners. Table 1 demonstrates the three categories with typical examples of stakeholder roles as recognized in the company.

Business-focused stakeholders are essentially requirements contributors whose engagement is to enable or constrain specific business-related capabilities. Their interests and goals vary in details but ultimately concern the delivery of business value

through the system’s functionality, or the resulting financial or political benefit. For instance, a business sponsor might initiate an IT project because she has received guidance from senior executives to focus on sales, improve margin, reduce time/cost, engage with customer better, or to improve reporting so that the business units can be more intelligent in their decision-making. Therefore, the business sponsor usually sets up the goals and directions for the project and assigns relevant business SMEs (Subject Matter Experts) to IT projects to work out the requirements details. Business-focused stakeholders might use the to-be-built or impacted system directly (e.g. users), indirectly (e.g. business sponsor) or not use at all (e.g. the legal consultant).

Development-side stakeholders are essentially requirements refiners who come from the downstream development teams, such as a SAP representative who might be a developer in the SAP development team. Their interests and goals are to provide or to secure the best solutions for the project (e.g. technical leads) and also for the organization (e.g. enterprise architects).

The last category of stakeholders is requirements practitioners who execute or facilitate the execution of the requirements decision-making process. Their general interests and goals are to successfully deliver the project through producing high quality requirements specifications in a cost-effective manner. Stakeholders in this category include BAs, BA’s manager, director of software development process especially requirements process if any.

In the next three sections, three case stories are described with sufficient details and varying focuses portraying three typical IT projects in the studied enterprise environment. They demonstrate different kinds of project situations such as the different levels of complexity in terms of the width and depth of the projects’ impact on both the business and the existing IT systems. These different project situations in turn affect the extent to which stakeholders participate and contribute to the requirements decision-making, especially for the development-side stakeholders. In order to clearly describe the stakeholders’ contribution practices, the presentation of the case stories is structured on the following questions concerning requirements decision-making:

- 1) Who participates in or influences the requirements decision-making?
- 2) What do they contribute to?
- 3) How do they make these contributions?
- 4) When do they make these contributions?
- 5) Why do they make these contributions?

B. Case Story 1: ToolSuite Cloud Improvement

ToolSuite refers to a suite of web-based global commercial tools for indirect customers (i.e. partners and distributors) to quote, configure, and order the company’s products and solutions. ToolSuite Cloud is a relatively new web-based application that sells the company’s cloud services and solutions specifically. However, in the initial launch ToolSuite Cloud does not support quoting with special bids, promotions or programs, and Electronic Data Interchange (EDI) ordering as the

ToolSuite does for indirect customers. Therefore, this case story describes an IT project tasked with goals to enable consistent special bids, promotions, programs, and EDI ordering for cloud services in ToolSuite Cloud. Furthermore, this project will implement some new functionality including bulk uploading of user details, and enabling variable trial length for cloud services. This project impacts 6 applications and systems including the existing ToolSuite Cloud application, ToolSuite, and SAP (responsible for order and contract creation, and billing etc.). Meanwhile, it impacts 8 different business areas such as the global sales operations, finance, promotions, and deals desk. Until the BRS sign-off, a minimum of 16 stakeholders were engaged in the requirements decision-making, as illustrated in Table II.

TABLE II. REPRESENTING STAKEHOLDER COMPOSITION IN CASE STORY 1

Business-focused		Development-side		The Rest	
Role / type	No.	Role / type	No.	Role / type	No.
Business Sponsor	1	Solution Architect	1	Business Analyst	1
Business SMEs	12	App. Team Reps	1		

The Business Sponsor – a lead for the cloud business operations, contributed to the requirements decision-making mainly (**How**) by submitting the project proposal and reviewing the BRS for sign-off. In the proposal, he defined (**What**) the business case, rudimentary project scope and high-level functional requirements. He emphasized in the business case the importance of supporting consistency across the ToolSuite and ToolSuite Cloud toolset for business processes such as quoting with promotions, which then serves as a business goal for guiding the subsequent requirements decision-making, e.g. adhering to the business rules in ToolSuite for cloud services in ToolSuite Cloud and reusing existing functionality in ToolSuite where possible. (**When**) The business sponsor had meetings with the BA separately from other stakeholders, and these meetings are often held at the beginning for clarifying business goals, and at the end for review and approval of the requirements process.

The Business SMEs – relevant operators of the impacted systems come from 8 business areas. They provide information about (**What**) their current business process does, and define business rules and process and new functionalities. For instance, one primary business SME coming from the Promotions team is requested by the BA to (**How**) do a demo of the existing process and business rules for quoting with promotions in ToolSuite and then helping defining the requirements for supporting quoting with promotions for cloud services in ToolSuite Cloud. (**When**) The primary business SMEs who are on the approval list for sign-off participated the requirements meetings very frequently throughout the process, while secondary business SMEs, who come from those business areas which are not drivers of the project but being indirectly challenged, participated only when requested by the BA.

The App. Team Reps – a SAP representative is engaged because the project has significant impact on the SAP. With SAP being treated as a black box, he is tasked with producing a SAP blueprint in parallel to the BRS requirements decision-making. More importantly, during the requirements decision-making process he shared what is in place in SAP which not only encourages reuse but also validates new requirements in terms of feasibility. However, with his engagement also came very detailed requirements decisions, or pre-mature design decisions, in the BRS. For instance, “SAP will contain the Threshold/Discount schedule” is specified as a data requirement in the resulting BRS.

The Solution Architect – a job role always assigned to each IT project with the responsibility to ensure the IT-business partnership including alignment on strategic plan, deliverables, and business case values. He was periodically engaged in requirements meetings but most active at the end for reviewing the BRS. It is evident from the revision history in the BRS that the solution architect has the power to determine when a BRS is complete and ready for development. We found that five more revisions, due to feedback from the solution architects and the SAP representative, are recorded right after the approval from the business sponsor. Among these additional revisions records, there are additions of reporting requirements in order to align with the business metrics of this project, e.g. “ToolSuite Cloud must be able to report on the number of Cloud Services orders that have requested a Special Bid”.

One influence from the solution architect - There is a requirement change, identified in a use case, in a step of the process flow for enabling EDI ordering for ToolSuite Cloud services. The process step is changed from “Quoting system – Sends the EDI Order to SAP (Existing interface)” to “Quoting system – Sends message to ToolSuite Cloud to order quote (New interface)”. Although both approaches can realize the goal for enabling EDI ordering, the solution architect still asked for change. That is because firstly the IT holds the vision that all cloud orders shall be dealt with via the ToolSuite Cloud application, and the original requirement violates this vision Secondly, the proposed alternative is more cost-effective than implementing option 1 in the long term because better cohesion is supported by all the cloud orders (either standalone order or hybrid) being handled solely through interfaces between the ToolSuite Cloud and the SAP.

One consequence of the stakeholder composition in this project – It is evident that this project has inadequate participation of development-side stakeholders, especially the App team representatives. Then the researcher interviewed the technical lead of this project for any issues about the BRS. His feedback revealed that his team had many meetings with the business sponsor to clarify some requirements. It demonstrates that inadequate engagement of the primary development-side stakeholders could result in ambiguous or incomplete requirement, for instance, “In the BRS the requirement for bulk uploading of user details, (it) only talks about uploading user details. But if you go to the original requirement (in the project proposal) it talks about [a cloud service] provisioning efforts. Provisioning needs some more information like the (cloud service) number.”

C. Case Story 2: OWC Content & Sites Integration

This project is initiated by the IT rather than any business units tasked with developing a dynamic solution for managing the websites content of 4 business units, Human Resource, Sales, Marketing and Support. At present, each of the 4 business units has their own website utilizing Oracle WebCenter Sites (OWCS) instances and Oracle WebCenter Content (OWCC), an enterprise document management system. However, as per the current architecture, OWCS and OWCC are not linked. The architecture of OWCS instances are configured to only receive content directly from the first authors publishing through manual push to each sites instance which creates a lot of duplications of content and effort if it is to publish at multiple sites, and also results in process inefficiencies. So this project is tasked with goals to integrate current OWCC with OWCS so that content authors can publish content in a central repository (i.e. OWCC) once and auto-publish by sharing documents across portals without duplicating efforts. The minimum stakeholder composition as counted by the names appeared in the BRS is outlined in Table III.

TABLE III. REPRESENTING STAKEHOLDER COMPOSITION IN CASE STORY 2

Business-focused		Development-side		The Rest	
Role / type	No.	Role / type	No.	Role / type	No.
Business SMEs	11	Project Sponsor	1	Business Analyst	1
		Technical Lead	1	Project Manager	1
		Solution Architect	1		
		App. Team Reps	6		

The project sponsor - a director from the enterprise content management in the IT department, submitted a project proposal that already contains a high-level solution in the form of an architectural diagram. It serves as a proposed process flow. Of this, however, the details of new functionalities still depend on the input from the business SMEs. More accurately speaking, it depends on the partnership of the IT and the business to make decisions together. For instance, to realize the goal of integrating OWCS and OWCC while treating OWCC as the central repository, a new metadata structure is proposed by the application representatives which then leads to the need of a new function that publishers (i.e. business SMEs) shall complete the metadata specific to the target portal(s) when uploading a document. Such kind of decisions need to be agreed by both sides.

In this project, the application team representatives participated more actively in requirements workshops and provide feedback when the BA requests for any information or thoughts. Furthermore, their engagement is more frequent at the end during requirements reviews.

Because of the frequent engagement from the development-side stakeholders, **one characteristic** of the resulting BRS is that 7 out of the total 23 functional requirements are a mix of pre-mature design decisions and functional requirements. In the

meantime, some other requirements are relatively high-level, such as “The OWCS management user privileges on each documents should be maintained when the document is migrated to OWCC”, because the details of those requirements are already known by the development teams. In this context, development-side stakeholders influence the granularity of the requirements decisions.

D. Case Story 3: ToolSuite Direct Customers

At present, quoting and ordering for direct customers, as well as other related process steps such as special bid processing are done outside the ToolSuite toolset with multiple manual steps, disconnected process steps and heterogeneous pricing methodology. This case story depicts an IT project which is to enable ToolSuite to manage the direct business with goals to make dealing with direct business more efficient, and also to produce a higher quality output, with less manual checkpoints. This case story was phase 3 of the project in which the goals were to enable standard quotes, special bids and discretionary discount for direct customers.

This project involves a great many of stakeholders in a broad spectrum because it has impact on 15 existing systems as well as 6 business units such as sales, finance, sales technical support and operations. Table IV reflects the minimum composition of stakeholders for the case story.

TABLE IV. REPRESENTING STAKEHOLDER COMPOSITION IN CASE STORY 3

Business-focused		Development-side		The Rest	
Role / type	No.	Role / type	No.	Role / type	No.
Business Sponsor	1	App. Technical Lead	4	Business Analyst	1
Business SMEs	27	Solution Architect	1	Project Manager	1
Legal	1	Enterprise Architect	1		
		App. Team Reps	4		
		User Experience Designers (Web)	2		

Technical Leads - Because of the complexity of the project, the BA has asked a technical lead, who is an expert in ToolSuite, to provide an overall ToolSuite systems architecture diagram for the direct business before the BRS workshops kicked off. This architecture diagram has served as an overarching context / as-is environment in the BRS.

App. Team Reps. - In the second requirements workshop, a ToolSuite application representative proposed an idea of having a centralized storage for all the transaction related documentations because the current implementations store documents in a dispersed and replicated fashion which not only consumes storage space but also is not good for synchronization. Then some business SMEs liked the idea and agreed to discuss that further in the next meeting. As a result, enabling centralized storage becomes a departing point that many subsequent requirements need to be determined including the scope (what are these transaction documents and in which application they are generated), the upload and storage flow, the viewing and

retrieval points and flow, and the end-to-end tracking capability. To discover and make those requirements decisions, relevant business SMEs and application team representatives worked together.

The Requirements Process Director - made an announcement during a BAs' weekly reporting meeting that he encourages BAs to incorporate the digital signature solution that the company bought into projects wherever possible. Consequently in this project as it involves requirements that customers have to submit a signed order form for ordering and then get validated, the BA then proposed to leverage the digital signature technology so as to drive efficiency. Then the technical lead gets involved for this discussion as well.

The enterprise architect - participated only once in a review workshop due partly to his tight calendar schedule and partly to the fact that this project is already phase 3 and many key decisions are already made in previous phases. In one conversation when the first author mentioned an observation that there were more than 14 stakeholders participating in those requirements workshops but merely about half of them were actively engaged (i.e. making comments or suggestions), then the enterprise architect responded "for myself I'd like to occasionally join in the conference call and make no voice at all but it's not bad. I can hear what is going on and understand the problems". In addition, two BAs' feedback on the enterprise architect provides more insight, "The EA gets involved generally for requirements that are ground breaking/controversial or that have multiple possible solutions or where the Tech lead (IT Dev Prime) is insisting on something that is pure daft and we disagree with."

E. A Framework of the Stakeholder Contribution Pattern in the Studied Enterprise Development Environment

Grounded in case stories such as the three described in this paper and feedback from the relevant stakeholders in conjunction with analysis of documentations such as the requirements specification, requirements workshops minutes and project proposals, a framework of stakeholder contribution practices is formed surrounding the following five dimensions.

WHO - Role: the first dimension of the framework reveals the role of the stakeholder in the requirements decision-making. Understanding that not all projects would need or be able to get the engagement of all the stakeholder roles as shown in Table I, the stakeholder contribution practices described in the framework outline the circumstance in which each stakeholder role is engaged in a project.

WHAT - Content / Characteristics / Efficiency: this dimension addresses the essence and effect of the contribution. Various stakeholders might contribute to the content of the requirements, shape the characteristics of the requirements decisions, or influence the efficiency of the requirements decision-making process.

HOW - Activity / Task: this dimension clarifies by what means various stakeholders make their contributions. Some contribute by attending requirements workshops while others might prefer communicating via emails. To break it into further details, different stakeholders are often assigned specific tasks

due either to their responsibility in the project or to the request asked by BAs.

WHEN - Time & Frequency / Situation: the fourth dimension specifies under what kind of project situation a stakeholder role is required to be engaged and the point at which the stakeholder becomes engaged in the requirements decision-making process as well as the frequency.

WHY - Goals and Interests: the last dimension explains the stakeholders' motivations (goals and interests) for participating in the requirements decision-making process.

For business-focused stakeholders, their inputs contribute to **the degree of the business value** of the project. Business or project sponsor, with the interests and goals to gain business value from the successful delivery of IT projects, makes contribution to business case and metrics, project scope, and final requirements, through the submission of the project proposal, determine the scope and final requirements, and changes of scope. Business SMEs, interested in improving their work efficiency and productivity or just for the purpose of assisting the BAs when requested, have the most input in BRS, contributing insights for the current and proposed business environment via demos, examples, screen shots, documentations etc., and defining functional requirements including business rules in details. The primary business SMEs attend all requirements workshops while the secondary business SMEs often attend those that interest them.

For development-side stakeholders, their inputs contribute to **the degree of feasibility and completeness of requirements decisions, the granularity of requirements decisions and also the degree of fitness to the organization roadmap and enterprise architecture**. Generally interested in assessing the impact of business changes on existing implementations and also the feasibility, development-side stakeholders often drive questions during requirements reviews or even after BRS sign-off which further refines the requirements. Moreover, the solution architect advises BAs, while the technical lead might ask for a specific level of details for the BRS.

For requirements practitioners, their inputs contribute to **the quality of requirements specifications and also the efficiency of the requirements process**. BAs collect and analyze information to fulfill their responsibility for creating the BRS, specifying goals to ensure its quality, and for the efficiency. With the knowledge they have of the existing IT and business environment, along with the visions communicated from upper management, they propose requirements and facilitate the discovery and agreement of ideas for new requirements. For BAs' manager and the requirements process director, with their goals to monitor and ensure the quality, clarity and timeliness of the BRS, they review weekly updates from BAs about their projects progress and provide help when needed but meanwhile often set deadlines for projects which in turn affects the ways BAs create BRS.

Due to the limited space here, the elaborated early-stage framework of the stakeholder contribution pattern can be found in this website (<http://www.ifengchen.com/research/stake-contributionpattern/>).

V. DISCUSSION

The observations in the study found that the IT personnel, and especially senior business analysts, are equally knowledgeable about the existing process and capabilities as compared to the business side stakeholders. However, the involvement of IT development-side stakeholders in requirements decision-making is undervalued in the studied environment. Another observation is that a considerable amount of workshops time is spent on searching and sharing information of the existing business processes, capabilities and constraints which could come from either the business-focused stakeholders or the development-side stakeholders. While the business cases coming from the business or project sponsor guide the overall direction, the information inputted by the business-focused stakeholders and especially the development-side stakeholders drives the progress of the requirements decision-making, because ideas for new requirements are discovered and determined when further information is known. An empirical study of RE practices [20] found that the best practice for elicitation was assessing system feasibility. Engaging the development-side stakeholders at the right time, therefore, not only ensures effective progress in requirements decision-making but also increases the requirements quality and reduces risks caused by uncertainty.

With an understanding of the stakeholders' contribution pattern in the studied enterprise development, several lessons are learned: 1) make the BAs the focal point of requirements information; 2) value the input from the development-side stakeholders, especially for their input in requirements reviews.

VI. CONCLUSION AND FUTURE WORK

This paper articulates a new stakeholder classification and a framework addressing a stakeholders' contribution pattern illustrated with three industrial case stories along with feedback from practitioners. In enterprise development, stakeholders engaged in requirements decision-making comprise three kinds: the business-focused stakeholders primarily contributing to the degree of business value; the development-side stakeholders mainly contributing to the degree of feasibility and completeness; and the requirements practitioners contributing to the quality and efficiency. This study stresses the importance of the IT-business partnership in requirements decision-making and also emphasizes that development-side stakeholders are of equal importance as the business-focused stakeholders. Understanding the contribution pattern of different stakeholders from the perspective of Who, What, How, When and Why can help project managers and BAs to develop better plans and strategies to engage the right stakeholders at the right time and thus improve the effectiveness and quality of requirements decision-making. Future work could focus on extending the framework within the context of other software development models (e.g. Agile) to find other stakeholder contribution patterns in requirements decision-making.

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