

How to do Successful Chargeback for Cloud Services

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Abstract. With pay-per-use pricing models, elastic scaling of resources, and the usage of shared virtualized infrastructure, ‘the Cloud’ offers more efficient use of capital, great cost reductions, and breakthrough agility. Yet, it turns out that to leverage the cloud advantages, organizations have to introduce cloud-specific chargeback practices. That is, they have to allocate IT service costs to business users in a way that reflects service consumption. To help organizations transition to a cloud environment, this work provides an overview of the factors that impact the design of successful cloud-specific chargeback models. The findings can assist organizations in the design of chargeback models that allow the business flexibility and cost reductions associated with the Cloud to be fully leveraged. The results are based on an empirical study involving twenty-five field experts from IBM and its client and partner network.

Keywords: IT chargeback, IT cost allocation, billing, IT chargeback models, economics of cloud computing, and factors impacting chargeback success.

1 Introduction

In Information Technology (IT) management, chargeback or charging, refers to the practice of charging the costs of IT back to the different departments and business units that use IT [3, 16, 31]. Chargeback makes service consumers aware of the costs of IT and it is generally used to control escalating IT costs, to improve decision making, to align behavior with organizational goals, and to lead to a more effective use of IT [13]. However, in comparison to charging back for physical products, chargeback for intangible products such as IT is still poorly understood by many organizations [16], and is rarely applied to their advantage because of the lack of successful chargeback models that are well aligned with organizational objectives and are clear and acceptable to all the involved stakeholders [26].

To make the situation more complicated, organizations are adopting cloud computing (CC), an environment with untraditional and non-fitting characteristics from a chargeback perspective. With pay-per-use pricing models, elastic scaling of resources, and the usage of shared virtualized infrastructure, the Cloud fundamentally changes the economics of IT [18]. It enables more efficient use of capital, cost

reductions, and business flexibility. However, to fully leverage those benefits organizations also need to employ some form of pay-per-use based chargeback, something that is seldom done in the current chargeback practices [29]. Failure to allocate cloud-based costs in a per-use manner can lead to an explosion of unnecessary consumption that can offset the cost reductions and to an inability to leverage the business advantage offered by flexible pricing [29]. Yet, the current chargeback models are oriented towards more traditional IT environments in which costs do not vary with usage. This raises the question how to develop chargeback models that are suitable for cloud services.

The design of better chargeback models for cloud services requires understanding of the factors that make a chargeback model successful in a CC environment. This need was expressed in six interviews by three service management specialists from IBM who were increasingly faced with the problem of helping their clients to adjust their chargeback practices for the dynamics of the Cloud. The scientific literature offers hardly any answers. This leads to the formulation of the research question:

What factors that can be influenced through the design of a chargeback model impact the success of a chargeback model for cloud services?

Answering the above research question adds both scientific and societal value. From an academic perspective, to the best of own knowledge, this is the first work to offer a systematic list of factors influencing the success of chargeback for cloud services. As we validate the list with a diverse group of field experts, the findings can help organizations realize the implications of the Cloud for their chargeback models, and how to improve the latter.

The research question is answered by reviewing the relevant literature on the topic of chargeback and Cloud. In addition, twenty-five semi-structured interviews are conducted with field specialists from IBM and its client and partner network.

The rest of this paper is structured as follows. Section 2 provides an overview of the relevant literature. This is followed by descriptions of the research method in Section 3, and of the discovered and validated factors in Section 4. The discussion and conclusion are in Section 5 and Section 6, respectively.

2 Theoretical Background

According to the notion used behind the term chargeback in the scientific and management literature [15, 16, 21, 23, 28, 31], chargeback for cloud services can be defined as the process of allocating the costs of the cloud services that an organization provides to its employees to the organizational units that use those services. In contrast, a chargeback model is just a conceptual representation of how the costs are allocated to the organizational units using those services. Thus, the chargeback process could be viewed as an implementation of the model.

Regardless of the terminology, chargeback is mainly recognized as a means of IT governance [8, 16, 28] that enables IT cost reductions. On the consumption side, it makes users cost-aware and results in a more cost-efficient choice of services [12,

16]. On the delivery side, increased understanding of service costs facilitates more effective IT investment and provisioning decisions [11, 13].

2.1 Cloud Computing

Vaquero et al. [32] provide a comprehensive definition of CC that is adopted here. According to them cloud services are provisioned from clouds and “clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the [provider] by means of customized [Service Level Agreements] (SLAs).” Furthermore, it should be added that cloud services, are delivered over a computer network or the Internet [1].

Especially relevant for the topic at hand are the characteristics that differentiate CC from a traditional IT environment. Thus, Table 1 describes a list of five fundamental characteristics of CC that describe it well and differentiate it from traditional IT [33].

Table 1. Five characteristics of the Cloud that set it apart from traditional IT (based on [33]).

Cloud characteristic	Description
Flexible pricing /Pay-per-use	Computing capabilities are exploited in pay-per-use models. Users have to pay for the actual consumption of services and/or resources.
Elastic scaling	Resource availability can scale up or down by large factors as demand increases/decreases
Rapid provisioning	Computing capabilities and services are immediately provisioned without physical delivery and transferring ownership or resources.
Standardized offerings (through self-service)	Cloud services are highly standardized and offer limited customization. They are usually available through self-service interfaces and the request and provisioning processes are automated.
Virtualization	Computing resources are virtualized to provide independence of the underlying infrastructure and optimal utilization of resources.

Two high level business advantages of the Cloud are also relevant for understanding the discussion in the following sub-section on the impact of CC on chargeback. Firstly, the Cloud can offer substantial cost reductions that are enabled by high utilization of resources due to virtualization, efficient use of capital due to pay-per-use, automation, standardization, and self-service [18, 22]. Secondly, the Cloud also offers great business flexibility, because of the flexible pricing, rapid provisioning, and elastic scaling [1, 22].

2.2 Impact of Cloud Computing on Chargeback

Recent research on the impact of CC on chargeback shows that organizations that want to fully leverage the benefits of the Cloud should apply pay-per-use chargeback

practices [29]. No per-use charging for cloud services leads to an explosion in consumption and to a subsequent increase in costs that can offset the cost reduction benefits of the Cloud. Furthermore, for internal users, no pay-per-use chargeback for cloud services diminishes the business value of CC. From a business perspective pay-per-use is an advantage because costs follow value generation and demand, subsequently allowing efficient use of capital and flexibility in consumption behavior.

To sum up, the need to charge for Cloud is compelling. However, there are numerous challenges to that [29]. For example, how to match between individual consumers and the costs of the shared virtualized infrastructure behind the Cloud? What pricing models (e.g. subscriptions or some forms of metered service consumption) are most suitable for the different types of cloud services? How to charge the costs of the overprovisioned resources that are necessary to enable elastic scaling? To provide practitioners with a helpful tool with which to address those problems the following section lists some factors that influence chargeback success.

2.3 Factors that Influence Chargeback Success

A review of the literature reveals five factors that are explicitly mentioned by some authors. Furthermore, a few more factors can be inferred through detailed analysis.

Explicitly mentioned factors. The five concepts that are explicitly recognized in the scientific literature to influence chargeback success are accuracy, cost of costing, transparency and understandability, controllability, and fairness.

Accuracy. Accuracy is a factor influencing chargeback success that is universally recognized by scholars [3, 7, 11, 16, 20, 28]. This is a property of a chargeback model that describes to what extent the charges allocated to an organizational unit for each service accurately approximate the actual costs incurred by the organization for delivering the service to the unit. The better the costs are approximated with the charges, the higher the accuracy of the chargeback model. High accuracy has a profound two-fold effect on the success of chargeback. Firstly, it is conducive to realizing cost reductions, because it bases both provisioning and consumption decisions on actual costs [7, 11]. Secondly, it makes chargeback more acceptable to the involved stakeholders, because it motivates the correctness of the charges and prevents attempts for overthrowing the model based on low accuracy arguments [28].

Cost of costing. While high accuracy has positive impact on the successfulness of a chargeback model, it might be expensive to achieve. The term *cost of costing* is used to quantify the costs of the application of chargeback and accounting models and to compare them against the potential benefits [2, 9, 19]. The employment of chargeback models is associated with significant design, implementation, labor, and IT systems costs. Therefore, chargeback designers should take the costing factor into account in order to develop models, the benefits of which outweigh the related expenses.

The direct impact of the cost of costing on success is negative, because those costs offset the cost savings realized through chargeback. However, by investing in

improving accuracy, for example, the success of the chargeback model could be indirectly enhanced. Therefore the design of a chargeback model should be optimized to balance between costs and accuracy, as well as other factors that positively affect success at the expense of higher costs [9, 19].

Transparency and understandability. Researchers who investigate organizational behavior in relation to chargeback note that a chargeback model should be understandable and transparent to the involved stakeholders [11, 30].

Understandability describes whether the charges recipients understand what they are charged for. That is, do they understand the units of service and their prices? For example, charges for cloud services based on a user subscription are more understandable than charges based on utilized central processing unit (CPU) cycles.

Transparency, on the other hand, describes whether the involved stakeholders understand how the charges are formed. Therefore, transparency characterizes the capability of stakeholders to comprehend the chargeback model and the opportunity to enjoy non-obscure chargeback processes, while understandability deals with the capability to understand the charges, the end product of applying the chargeback model.

The two concepts are closely related and discussed together in the literature [11, 30]. Understandability is necessary in order to have transparency, because lack of understanding of the charges themselves (low understandability) leads to inability to comprehend the process of forming the charges (low transparency).

The major effect of transparency and understandability on chargeback success is related to obtaining stakeholders' buy-in. Low transparency and understandability lead to resentment of the chargeback model [11, 30].

Controllability. Nolan [25] uses the controllability concept to denote to what extent consumers are in control of their IT costs. Chargeback models that enable users to have impact on IT bills by changing consumption behavior have high controllability. On the contrary, if users cannot influence IT bills, then controllability is low.

Controllability has profound impact on chargeback success. On the one hand, it is essential to enable cost reduction opportunities on the consumption side, because it allows managers to reduce their IT bills by changing consumption behavior. On the other hand, controllability influences the users' acceptability for the chargeback model [25]. Low controllability leads to resentment, because chargeback is perceived as unnecessary overhead that does not benefit managers, while high control allows them to realize cost reductions and accept the chargeback model.

Fairness. Fairness is another concept investigated by chargeback researchers [20, 21]. Those authors dub *perceived fairness* (PS) "*the key to chargeback systems effectiveness.*" In their works, "*allocative*" *fairness* is used as a synonym to accuracy, while *perceived fairness* refers to user's perception of how fair the method is. It is unclear, however, whether in this case the term *fair* can be used as a synonym to the words "just" or "unprejudiced." Managers' self-interest and opportunism lead to perception of high fairness only when the chargeback model is consistent with their

goals (e.g. allows them to get a higher bonus because their profit increases due to lower IT costs). On the other hand, if a chargeback model is highly accurate, or “allocatively” fair, but leads to higher IT costs for a manager, he/she might be likely to perceive the model as unfair.

Therefore, the term PS could be considered a misnomer, because of its slightly contradictory meaning to the word *fair* (just, unprejudiced). Nevertheless, it is a useful concept to describe stakeholders’ attitude towards the chargeback model and whether they are likely to accept (high PS) or reject it [20, 21].

Inferred factors. A close inspection of the above factors influencing chargeback success reveals that their impact is realized in two separate ways. The examined forces either affect the effectiveness of the model [3, 11, 12, 25, 27], or the acceptability to the stakeholders [11, 20, 21, 25, 30]. These two aspects of chargeback success are used in the authors cited above to describe how accuracy, cost of costing, transparency and understandability, and controllability affect success. According to the above-referenced works, Fig. 1 visualizes how acceptability and effectiveness can be recognized as two high level dimensions that explain how the other forces influence success (Fig. 1).

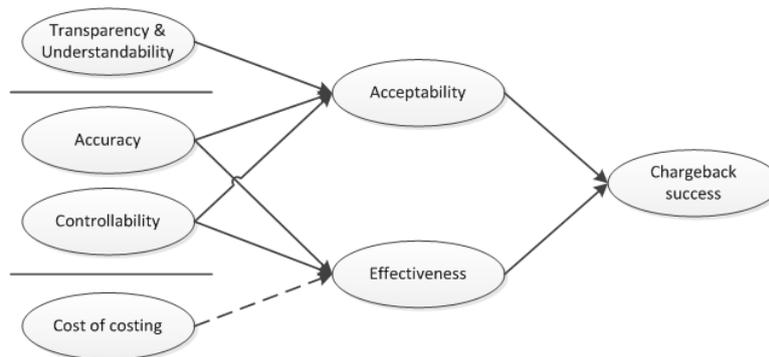


Fig. 1. Factors that impact success according to the scientific literature [3, 11, 12, 20, 21, 25, 27, 30]. Solid arrows visualize a positive relationship, while the dashed ones depict a negative relationship. Fairness is merged into acceptability and discussed further below.

Effectiveness determines whether the chargeback model stimulates the desired chargeback results, such as cost awareness and control, behavior steering, minimization of internal conflicts, more competitive costing and pricing.

Acceptability describes whether all the involved stakeholders find the model acceptable. High acceptability means that stakeholders find the model agreeable and are supportive of the chargeback process, while low acceptability stands for the lack of support for the model and results in resentment for the model.

In Fig. 1, fairness has been merged into acceptability because the latter excellently captures the meaning implied by Hufnagel and Birnberg [20, 21]. The substitution is

appropriate, because those authors equate low PF to the resentment of the model, while high PF is considered equivalent to the acceptance of the model.

3 Research Method

The above factors resulting from the literature review tend to apply for chargeback in general and do not take into account the characteristics of the Cloud. In the following research step, semi-structured interviews with Cloud and chargeback professionals were conducted to verify whether those factors indeed applied in a cloud environment and what other dimensions had to be also taken into account.

3.1 Interviewee Selection Process

To identify an extensive list of factors that influence chargeback success, twenty-five semi-structured interviews were conducted with field experts from IBM and IBM's client and partner network. Respondents from different backgrounds and positions were selected to ensure the comprehensiveness of the findings. Five types of stakeholders were identified in total: executives and board members, chargeback specialists, charges recipients, IT specialists, and consultants.

Despite the differences in background, all interviewees also shared some common characteristics. They were from Dutch origin and worked for seven large organizations in The Netherlands. In Table 2 below, each organization is briefly described in terms of industry and size.

Table 2. Organizations participating in the research by industry, size and number of respondents.

Alias ¹	Industry	Size (N ₂ employees)	N ₂ of respondents
IBM	Consulting, technology	> 10,000	16
INS1	Insurance	1,000 – 10,000	1
INS2	Insurance	1,000 – 10,000	2
MUN	Government/municipality	1,000 – 10,000	1
GOV	Government	> 10,000	3
TRANS	Transportation	> 10,000	1
HOUS	Housing/construction	1,000 – 10,000	1

3.2 Interview Structure and Research Approach

The objective of the interviews was to ask the participants to identify what characteristics of a chargeback model affected its success and how. This required respondents to be given the opportunity to freely discuss the topic and the researcher to ask clarifying questions. The need for free bi-directional communication precluded

¹ For confidentiality reasons aliases are used for the names of partners and clients of IBM.

the usage of questionnaires or formally structured interviews [10, 24]. Thus, semi-structured interviews were preferred over unstructured interviews to allow comparison between the responses of the different participants and to keep the interviews focused on the topic [24].

A two-page interview guide was developed to impose a common structure on all interviews. On top of an introduction and wrap-up, it contained sections with interviewee background and experience, unguided questions, guided questions, and cross-validation. In the introduction the researcher and the research topic were introduced, while the background check was used to determine the stakeholder category of the interviewee.

In the guided and unguided sections the respondents were asked questions such as: “What characteristics of a chargeback model do you find relevant for the success of a chargeback model for cloud services?” and “How do those characteristics influence success?” No directions were provided by the interviewer, and subsequent questions were asked mainly to clarify what the interviewee meant by a certain concept. In the guided part of the interview, the concepts identified from literature were introduced and the respondents were asked to comment on them. It was also queried if they brought to mind additional factors. Finally, the cross-validation phase was used to validate the findings. This is discussed in the following sub-section. The wrap-up was used to verify whether the researcher had properly captured all the points made by the interviewee.

3.3 Cross Validation

The twenty-five interviews were used to empirically cross-validate the findings for correctness and completeness. Correctness was evaluated by asking the respondents whether all the discovered factors were relevant for the success of a chargeback model. Completeness was determined by asking the participants to comment on the comprehensiveness of the compiled list. Since the latter was always larger than the list identified by each individual interviewee, the participants mostly made positive comments on comprehensiveness. Therefore, the method described below was also applied to more reliably evaluate completeness.

Since it was impossible to guess how many interviews would be necessary to reach an “extensive” list a priori, a theoretical data saturation principle was applied to empirically determine the required number [14, 17]. Interviews were conducted until the moment a data saturation point was reached, i.e. the list of discovered forces started to converge and no additional factors were brought up in subsequent interviews. At this point it was deemed that the probability for additional findings from questioning more respondents was too low to justify the required research efforts and the list was considered as sufficiently complete. It was experienced that the saturation point had been reached by the twenty-fifth interview, because after interview number twenty-one each discovered factor had been mentioned at least four times, and no new factor had been identified since the twelfth interview.

4 Results

To start with, the results confirmed the relevance of the dimensions listed in Fig. 1. Furthermore, four additional factors were found to be conducive to chargeback success, and to be especially relevant in a cloud environment. These are measurability, predictability, accountability, and comparability. Table 3 displays how many respondents mentioned each factor during the interviews. Fig. 2 visualizes how all the identified factors impact success. Subsequently, the newly discovered factors are explained.

Table 3. Number of times each factor was mentioned during the interviews by background of the twenty-five respondents.

	Total ²	Executives	Chargeback recipients	IT specialists	Chargeback specialists	Consultants
Effectiveness	13	2	0	4	6	5
Acceptability	12	1	1	5	4	6
Measurability	6	0	0	6	0	3
Accuracy	21	2	4	9	6	9
Transparency & understandability	12	1	3	4	5	4
Controllability	8	0	3	4	5	1
Predictability	14	0	4	11	1	7
Accountability	7	0	1	4	3	1
Cost efficiency	8	2	0	3	1	5
Comparability	4	0	0	2	2	2

Measurability was a concept that was mentioned mostly by the interviewed IT specialists who had in depth experience with Cloud. The term was used to refer to the degree of ease with which the chargeback model allowed measuring how many service consumption units had been used and to determine who had used those. For example, if a certain service is charged based on completed transactions, it must be possible to count how many transactions have been completed over a charging period and by whom. High measurability implied that it was possible to measure usage without highly specialized or custom made metering systems, while low measurability required such technology.

The interviewees motivated the importance of measurability, by explaining that it was difficult to measure usage in the shared virtualized infrastructure behind the Cloud and that there were still a number of technical limitations of metering systems, especially when it came to charging units such as CPU cycles or memory. Yet, as one respondent remarked, “(...) usage based charging [was] possible only through measuring.”

² Since a few respondents fell into two stakeholder categories due to their diverse job responsibilities, the sum of the five rightmost columns is greater than the total count.

Regarding the impact of measurability on success, the interviewees suggested that it positively influenced both acceptability and effectiveness. From an effectiveness perspective the capability to gather detailed usage data allowed for effective decision making and more accurate charges. On the other hand, high measurability reassured the stakeholders in the accuracy of the model, consequently improving acceptability.

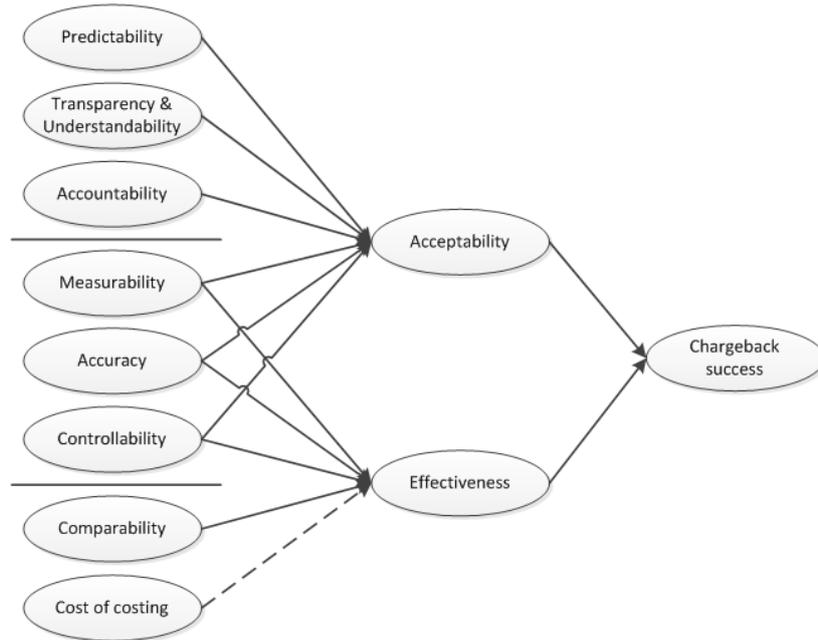


Fig. 2. Factors impacting the success of a chargeback model.

Predictability describes to what extent chargeback recipients are able to predict future bills. Predictability becomes far more significant in a cloud world, because pay-per-use and elastic scaling of resources could lead to fluctuating bills that tend to bother budget minded managers. The latter do not mind bills that are smaller than expected, but it turns out that they are afraid of bills that greatly exceed expectations. Despite these concerns, the interviewees commented that predictability did not impact the effectiveness of the chargeback model. It affected only the acceptability, as unpredictability led to resentment towards the chargeback model.

Accountability is the extent to which charges recipients are able to verify the correctness of the bill. The easier it is for them to do it, the higher the accountability, and consequently, the higher the acceptability. Fixed subscription fees on a per user basis offer the highest accountability, because managers are just able to multiply the number of people in their team by the amount of the subscription fee and verify the correctness the bill. However, accountability decreases when metering of IT resource consumption is involved, such as transactions made and bandwidth consumed, because that requires from managers higher technical competence and access to specialized IT systems.

The respondents motivated the relevance of accountability by explaining that they often witnessed disputes, sometimes well-grounded, over the correctness of the bill. One interviewee summarized the general opinion as follows: *“The lower the accountability, the more often you see disputes over the bill.”*

Comparability is the degree to which consumers are able to compare the prices of internally provisioned services to similar or equivalent services offered on the market. The standardization characteristic of the Cloud leads to the availability of highly similar standardized services available on the market. Therefore, in a cloud environment it becomes much easier to benchmark IT costs on a per-service basis. Yet, this still depends on how the chargeback model is designed, and whether internal service pricing follows the pricing patterns of public providers. If the chargeback model is designed in a way that allows easy price comparison, then comparability is high. This results in cost reductions on the provisioning side, because internal users who are able to compare prices start to exercise pressure for more efficient IT delivery on the IT department.

5 Discussion

A closer analysis of the results also provides additional insights about the chargeback landscape. To start with, the interview data show that the current chargeback literature is almost oblivious in regards to the Cloud and that further research in the field is necessary. This is suggested by the fact that all the factors identified through literature research hold both for traditional and cloud environments. With CC, however, additional factors such as measurability, predictability, and comparability have been put forward by the interviews.

Another intriguing conclusion that can be drawn from Table 3 is that different types of stakeholders tend to recognize different forces. This can be used to better explain the chargeback landscape, the rationale behind the behavior of individual stakeholders, and thus to remind chargeback designers to address the unique concerns of all stakeholders. Some notable patterns that can be identified from the results are the following: chargeback specialists do not seem to be concerned with the cost of costing; measurability is a force recognized mainly by IT specialists; predictability tends to be mainly a concern of chargeback recipients and IT specialists, but not of chargeback specialists. Below these trends and their implications are discussed.

The fact that only one out of six chargeback specialists mentioned the cost of costing is at first sight perplexing, because these professionals usually have strong accounting backgrounds and their task is to keep an overview of the involved financials. One possible explanation supported during the interviews is that the negative impact of the cost of costing is offset by the benefits arising from investing in improving other factors. Yet, this view seems to contradict previous research [9].

Opportunism might provide an explanation why chargeback specialists tend to avoid recognizing the importance of cost of costing. Firstly, higher cost of costing could be expected to provide more work for the chargeback specialists and to lead to increased job security. Secondly, the application of more complex and expensive

chargeback practices, but more challenging and interesting from a practitioner's point of view, could be regarded as a source of professional satisfaction.

The fact that only one out of six chargeback specialists mentioned predictability and none of them recognized measurability suggests that chargeback for Cloud is poorly understood, and that the current practices fail to leverage pay-per-use. If it were otherwise, then the concerns of charges recipient about predictability and of IT specialists about both predictability and measurability would have had proliferated also to chargeback specialists.

On top of information about the current chargeback practices, the discussion also confirms that chargeback involves a lot of political play and opportunistic behavior. For example, chargeback specialists might be inclined to adopt heavy chargeback processes both for job security and out of professional interest. Chargeback recipients might show resentment for the charging practices if the latter put them at a disadvantage, and external consultants and solution providers might have incentives to push through expensive technology and services. Therefore, chargeback designers should be well aware of possible opportunistic behavior and should take into account the positions of all stakeholders, as well as all the factors impacting success.

5.1 Limitations

The field specialists who participated in the semi-structured interviews, the performed cross-validation of the findings, and the adherence to a data saturation principle support the validity of the findings. Nevertheless, this research has some limitations related mainly to the choice of interview participants.

To start with, the Netherlands based chargeback experience of the interviewees brings forward the question whether the findings apply globally. European and North American organizations, for example, have a history of using different accounting approaches [6]. Nevertheless, there are a number of reasons that allow for a relatively reliable generalization of the results.

Firstly, no evidence for significant differences between chargeback practices in European and non-European environments was found in the literature. Moreover, the results confirm the findings from the predominantly U.S. based literature used for this research. Thirdly, the majority of the newly discovered criteria were mainly related to the technology characteristics of the Cloud and those are globally valid. Finally, the findings are motivated by location independent arguments why certain forces impact success. Due to all those reasons, it can be considered relatively safe to assume that the findings are valid at a global level.

Another potential limitation is that the results rely mostly on IBM's chargeback expertise, because more than half the respondents were affiliated with IBM. However, the aim of this research was to provide an extensive set of factors influencing chargeback success, rather than to rank the different factors in importance or to describe how chargeback concerns differed between organizations. Therefore, expanding the list of interviewees with additional respondents with broad chargeback and cloud experience from IBM can be viewed as an appropriate decision.

5.2 Future Research

To start with, the limitations presented above already offer some opportunities for future research. For example, this study could be replicated with different companies and in different geographic areas to explore whether there are additional factors that impact success in those environments. However, the findings presented here enable further research with far more significant contributions.

This work contributes to the understanding of the impact of Cloud on chargeback and the knowledge which dimensions of a chargeback model contribute to its success. These insights can be leveraged by researchers to develop cloud-friendly chargeback models and methods that assist chargeback designers to create such models. Furthermore, a system of metrics that allows the operationalization of the proposed above model of success factors can be developed. Such a system would not only allow for the impact of the different factors to be quantitatively verified, but would also enable research that measures the impact of different chargeback design decisions on success, and that fine-tunes chargeback models accordingly.

5.3 Contribution

To the best of own knowledge, this research provides the most comprehensive overview of the factors that impact chargeback success. Moreover, it explores the topic from the perspective of CC. Not only does this work empirically confirm the findings reported in the literature [3, 7, 9, 11, 16, 19–21, 25, 28, 30], but it also adds new factors that have not been known to researchers so far. Finally, it enables further research on the development of more cloud-specific chargeback models that can further improve how organizations benefit from chargeback and CC.

This work also has a significant societal contribution. In times of common views that IT investments do not pay back [4, 5], leveraging the findings could help improve the effectiveness of delivering and using IT in contemporary organizations. To start with, cloud adopters can benefit from this work by implementing chargeback models that can help them leverage the cost advantages and business flexibility of the Cloud and further reduce IT costs. Moreover, the results can be useful to cloud providers and providers of chargeback systems and services. Cloud providers can benefit by acquiring more knowledge about the chargeback requirements of their clients in order to offer more competitive pricing schemes. Vendors of chargeback software can update their products to better support cloud-specific chargeback models. Finally, providers of chargeback services can also use it to convince their clients of the value of external help in chargeback design and implementation.

6 Conclusion

This paper provides an overview of the factors that should be taken into account in the process of chargeback model design. Eight factors are empirically validated to affect the success of chargeback in a cloud environment – accuracy, cost of costing, transparency and understandability, controllability, measurability, predictability,

accountability, and comparability – and their impact on success is explained through two higher level variables, acceptability and effectiveness. The findings suggest that to develop successful chargeback models, chargeback designers should try to optimally balance between the presented dimensions and should address the concerns of the different stakeholders. Furthermore, while measurability, predictability, and comparability tend to be irrelevant or neglected in a traditional IT environment, the results evidence that special attention should be paid to these factors in a CC context.

Finally, a few concluding remarks are made on the timeliness of this work. The results emerge at a moment in which the adoption of cloud services is at its beginning. Therefore, the findings can promptly assist organizations that need to implement cloud-specific chargeback models as part of the transition to the Cloud. Rather than summarizing the accumulated chargeback experience once the transition is in a more developed stage, this research provides timely empirical findings that can enable immediate actions and future research that can further facilitate the move to the Cloud.

7 References

1. Armbrust, M. et al.: A view of cloud computing. *Commun. ACM*. 53, 4, 50 (2010).
2. Atkinson, A.A. et al.: *Management Accounting*. Prentice Hall, New Jersey, U.S. (2003).
3. Bergeron, F.: Factors Influencing the Use of DP Chargeback Information. *MIS Quarterly*. 10, 3, 225-237 (1986).
4. Carr, N.G.: *Does IT Matter? Information Technology and the Corrosion of Competitive Advantage*. Harvard Business Press, Boston, Massachusetts (2004).
5. Carr, N.G.: IT Doesn't Matter. *Harvard Business Review*. 81, 5, 41-49 (2003).
6. Chandler, A.D., Daems, H.: Administrative coordination, allocation and monitoring: A comparative analysis of the emergence of accounting and organization in the U.S.A. and Europe. *Accounting, Organizations and Society*. 4, 1-2, 3-20 (1979).
7. Cisco: *Managing the Real Cost of On-Demand Enterprise Cloud Services with Chargeback Models* [White paper], http://www.cisco.com/en/US/services/ps2961/ps10364/ps10370/ps11104/Cloud_Services_Chargeback_Models_White_Paper.pdf, (2010).
8. *Computer economics: IT Budget Chargebacks: Making Users Pay*, <http://www.computereconomics.com/article.cfm?id=1293>.
9. Cooper, R.: Cost management concepts and principles. *Journal of Cost Management*. Spring, 1987, 45-49 (1987).
10. Corbetta, P.: *Social Research: Theory, Methods and Techniques*. Sage Publications, London (2003).
11. Drury, D.H.: Assessment of Chargeback Systems in IT Management. *Infor*. 38, 3, 293-313 (2000).
12. Drury, D.H.: Conditions affecting chargeback effectiveness. *Information & Management*. 5, 1, 31-36 (1982).
13. Drury, D.H.: The dialectic of IT chargeback systems. *International Journal of Technology Management*. 14, 5, 496-512 (1997).

14. Eisenhardt, K.M.: Building Theories from Case Study Research. *The Academy of Management Review*. 14, 4, 532-550 (1989).
15. Finden-Brown, C., Long, C.: Introducing the IBM Process Reference Model for IT: PRM-IT Sequencing the DNA of IT Management. V3. IBM Global Services, Armonk, New York (2008).
16. Gerlach, J. et al.: Determining the cost of IT services. *Commun. ACM*. 45, 9, 61-67 (2002).
17. Glaser, B., Strauss, A.: *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Aldine Transaction, Piscataway, New Jersey (1967).
18. Harms, R., Yamaritino, M.: *The Economics of the Cloud*, (2010).
19. Holzer, P., Norreklit, H.: Some thoughts on cost accounting developments in the United States. *Management Accounting Research*. 2, 1, 3-13 (1991).
20. Hufnagel, E.M., Birnberg, J.G.: Perceived Chargeback System Fairness in Decentralized Organizations: An Examination of the Issues. *MIS Quarterly*. 13, 4, 415-430 (1989).
21. Hufnagel, E.M., Birnberg, J.G.: Perceived chargeback system fairness: A laboratory experiment. *Accounting, Management and Information Technologies*. 4, 1, 1-22 (1994).
22. IBM: Smarter Planet: Using cloud computing to deliver innovation and efficiency. Smarter Planet Client Events. , New York (2010).
23. Iqbal, M., Nieves, M.: *Service Strategy Book*. The Stationery Office, Norwich, UK (2007).
24. Kajornboon, A.B.: Using interviews as research instruments. *E-Journal for Research Teachers*. 2, 1, (2005).
25. Nolan, R.L.: Effects of chargeout on user/manager attitudes. *Communications of the ACM*. 20, 3, 177-185 (1977).
26. Oleson, T.D.: Price of precision. *CIO Magazine*, 13 (1998).
27. Raghunathan, B., Raghunathan, T.: A discriminant analysis of the relationship between IS charging systems and organizational variables. *Omega*. 22, 4, 321-330 (1994).
28. Ross, J.W. et al.: The Untapped Potential of IT Chargeback. *MIS Quarterly*. 23, 2, 215-237 (1999).
29. Stefanov, H.: *How to Charge for the Cloud? Towards a structured view of successful IT chargeback models for Cloud services*. Utrecht University (2011).
30. Stiller, B. et al.: Charging and accounting for integrated internet services - state of the art, problems, and trends. Presented at the INET'98: The Internet Summit, Geneva, Switzerland (1998).
31. VanLengen, C.A., Morgan, J.N.: Chargeback and maturity of IS use. *Information & Management*. 25, 3, 155-163 (1993).
32. Vaquero, L.M. et al.: A break in the clouds: Towards a Cloud Definition. *ACM SIGCOMM Computer Communication. Review*, 39, 1, 50 (2008).
33. Vos, J. de, Heusden, E. van: *Implications of Cloud Computing on IT Service Management*, (2010).