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REVIEW QUALITY MANAGEMENT - APPLYING ISO 9000 STANDARDS ON THE REVIEW PROCEDURE OF THE DESIGN SOCIETY

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1. Introduction and motivation

Reviewing papers is one of the key processes to determine the quality of a conference. The acceptance of a poor paper or the rejection of a good paper both has significant impact on the scientific exchange at any conference. The review procedure of the Design Society currently seems to have certain flaws. The spring meeting 2009 of the Board of Management and the Advisory Board of the Design Society in Boston revealed the following weaknesses: A lack of commitment on the part of the reviewers can be discerned. Also, the quality of the reviews is not being regularly assessed. Information barriers between the involved parties hosting and attending a conference do not allow for learning effects, neither for the reviewers and the organizers nor for the authors. Furthermore, there are cases of diverging reviews of one paper by two referees. This can, on the one hand, be attributed to the fact that assessing is always subjective, but on the other hand also may be ascribed to inconsistencies regarding the comprehension of the review criteria.

In summary, it can be stated that communication deficiencies and the lacking quality control of the reviews as well as disagreement on the review criteria have led to this actual state which is obviously unsatisfactory and does not exploit the Design Society's potential.

In order to tackle these problems, diverse approaches can be adopted. This paper examines if the principles of quality management according to ISO 9000 standards can be applied on the review procedure of the Design Society and tries to derive courses of action for dealing with the existing problems. It surely is not possible to present a proposal for a complete quality management system within the scope of this paper. The objective is to present an extract of the quality management system requirements and to highlight the application on the review procedure and the resulting recommendations.

2. State of the art in the field of peer reviews

Before analyzing the review procedure of the Design Society in terms of quality management systems, it is helpful to elaborate on the subject of the analysis: peer review. For, only if one understands the nature of peer review a corresponding examination can be carried out.

Peer review means the evaluation of a certain (scientific) performance by a peer, i.e. an expert in the specific field which the performance refers to. The performance being evaluated can be a manuscript for publishing in a journal or a project promotion application. Not only are scientific outcomes being reviewed: There are also peer reviews in organizations, universities and business companies in which an external peer evaluates an intern project, reorganization or other internal processes. This is quite common in the field of quality management.

Since decades peer review has been scrutinized and criticized. The critique refers to the lacking quality control of the referees, insufficient transparency and non-existing communication with the author as well as discrepancies among the referees [Cicchetti, 1997]. These are issues which have been revealed in studies conducted in the past. One of these studies is the one carried out by Peters/Cici (1982): They re-submitted articles at the same journal in which they already have been published. The result was that eight out of nine were rejected [Peters/Ceci, 1982].[Baxt et al., 1998] submitted a manuscript with minor and major flaws to all referees of the Annals of Emergency Medicine. Only a part of the mistakes was detected, the percentage of errors found varies depending on the severity of the error and if the referee has recommended or rejected the article for publishing. *"Sixty-eight percent of the reviewers did not realize that the conclusions of the work were not supported by the results. (...) Peer reviewers in this study failed to identify two thirds of the major errors in such a manuscript."* [Baxt et al. 1998] Furthermore, diverse studies have pointed out the fact that reviewing is imposed with bias and discrimination: The result of a review correlates with the native language [Herrera, 1999] and gender of the author [Wenneras, 1997], the age of the referee [Nylenna, 1994] but also with the consensus of the political attitude of both [Abramowitz, 1975].

The effort on the part of the reviewer is also in the focus of discussion: Referees expend a certain time on the review that keeps them from carrying out other work. Moreover, referees state that, when reviewing a manuscript, they often feel some kind of conformity pressure leading them to give a certain evaluation. Many reviewers also have claimed that they do not get any feedback on how their review performance was. Additionally, reviewers do ask for training in peer review which is provided by many institutions [Groves, 2006].

In order to correct the flaws of the peer review system, some alternative approaches have arisen lately. The online journal Philica founded by British scientists conducts an open peer review: The articles are published on the homepage and released for review. Any reader can anonymously state an evaluation of an article on the homepage. All reviews are public. By securing the transparency and allowing different views, the founders try to provide a learning effect for the authors. A similar approach is the dynamic peer review of the website Naboj which allows reviews of the reviews and thus a democratic approach for evaluating scientific performance. By means of the proceeding digitalization of scientific communication another flaw of the traditional peer review can be weed out: the so called publication lag – the time between the submission of the manuscript and its publication in the journal.

The approaches described above have not managed to gain overall acceptance yet. This surely can be attributed to the fact that open or dynamic peer reviews do provide more transparency and diversity but are unlikely to fulfil the filtering function for manuscripts for journals and conferences. One obvious point is that in those cases at least one referee must be obligated to do the review, otherwise the editor or the conference organizer runs the risk of receiving no review at all and therefore not being able to make a decision whether to accept or reject the article. Furthermore, the dynamic character of those review forms can not be appropriate when aiming at a decision by a particular point in time which is the case especially when hosting a conference. Hence, not the revolution but the evolution of the existing system should be objective.

3. Quality management according to ISO 9000 standards

3.1 Scope and fundamentals of ISO 9000 standards

The ISO 9000 family of standards has been developed to support organizations of all types and sizes to implement and operate quality management systems [ISO 9000: 2005]:

- ISO 9000 describes fundamentals and specifies the terminology for quality management systems.
- ISO 9001 specifies the requirements for a quality management system.
- ISO 9004 provides a guideline for improvement of the organization's performance and the satisfaction of the customer as well as other interested parties.

Together they constitute a coherent set of quality management system standards facilitating mutual understanding in national and international trade.

There are eight quality management principles that can be used by top management when aiming at improving the performance of the organization. They form the basis for the quality management system standards of the ISO 9000 family:

1.Customer focus

The organization must understand and meet the customer needs and strive to exceed their expectations.

2.Leadership

The leaders of the organization should create and maintain an internal environment in which the people can become fully involved in achieving the organization's objectives.

3.Involvement of people

The full involvement of people of all levels enables their abilities to be used for the organization's benefit.

4.Process approach

Activities and related resources managed as a process help achieving a desired result in a more efficient way.

5.System approach to management

Identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives.

6.Continual improvement

Continual improvements of the organization's overall performance should be permanent objective.

7.Factual approach to decision making

Effective decisions are based on the analysis of data and information.

8.Mutually beneficial supplier relationships

An organization and its suppliers are independent. Mutually beneficial relationship enhances the ability of both to create value.

By implementing a quality management approach an organization is encouraged to analyze customer requirements, define the processes that contribute to the achievement of a corresponding product and keep these processes under control.

The ISO 9000 standards describing requirements for a quality management system can be classified as process norms which are applicable for organizations of any sectors. They do not contain requirements for products which have to be identified by analyzing customer needs or must conform to legal requirements. Products in the ISO standards include, per definition, services, software, hardware and processed materials.

3.2 Conceptual frame: review as a service

According to ISO 9000:2005 a service is "*the result of at least one activity necessarily performed at the interface between the supplier (...) and the customer (...) and is generally intangible*" [ISO 9000:2005, p. 24]. Considering the activity of reviewing a paper, it is obvious that it fulfils these features: A review as the act of evaluating a scientific performance takes place at the interface between the referee and the author. The result of a review surely is intangible. In terms of a quality management system, the Design Society can be regarded as the organization and the review as the service provided by the organization. Hence, improvements of the review procedure can enhance the organization to gain competitive advantage and outstand amongst other organizations hosting conferences. The author is the customer, who submits a paper and states the intention to participate at the according conference.

Also, it could be thinkable to focus on the organization team of each conference as the organization which wants to improve its performance. The fact, that the organizers have a great impact on the review procedure as they are the ones to manage the submitted papers and their allocation to the referees, does suggest this. On the other hand, an isolated optimization of one single conference can be neither effective nor efficient. In order to achieve an improvement of the whole review performance it is indispensable to expand the focus and consider all review processes within the Design Society. Also, one important fact needs to be taken into account: The Design Society owns the rights to all

conferences and assigns the authorization to host a conference to organizing teams for each conference. Hence, the responsibility for the quality of the conference lies, after all, with the Design Society. For that reason, for applying the quality management principles on the review procedure, the Design Society shall be considered as the organization referred to in the standards. This does not mean, however, that all measures have to be enforced by the Design Society. This conceptual frame does not suggest the organizers' freedom of action to be curtailed. Assigning the role of the organization to the Design Society rather means widening the scope in order to ensure the standardization of the review procedure. The means by which this can be achieved will be described in the following sections and do involve the organizers' input.

4. Quality management system for the review procedure

ISO 9001:2008 contains requirements for a quality management system which constitute building blocks for forming and maintaining such a system. In the following sections those principles, which can be applied on peer review, will be presented. By analyzing their relevance for the review procedure of the Design Society, corresponding fields of actions will be elaborated for improving the review performance. However, the authors of this paper are aware that, when dealing with quality management issues, the Design Society cannot be regarded as a business company. Hence, only those principles of the ISO 9000 standards are presented that are suited for managing an organization as the Design Society.

The structure of the following sections is derived from the model of process-based quality management system of the ISO 9001 standards:
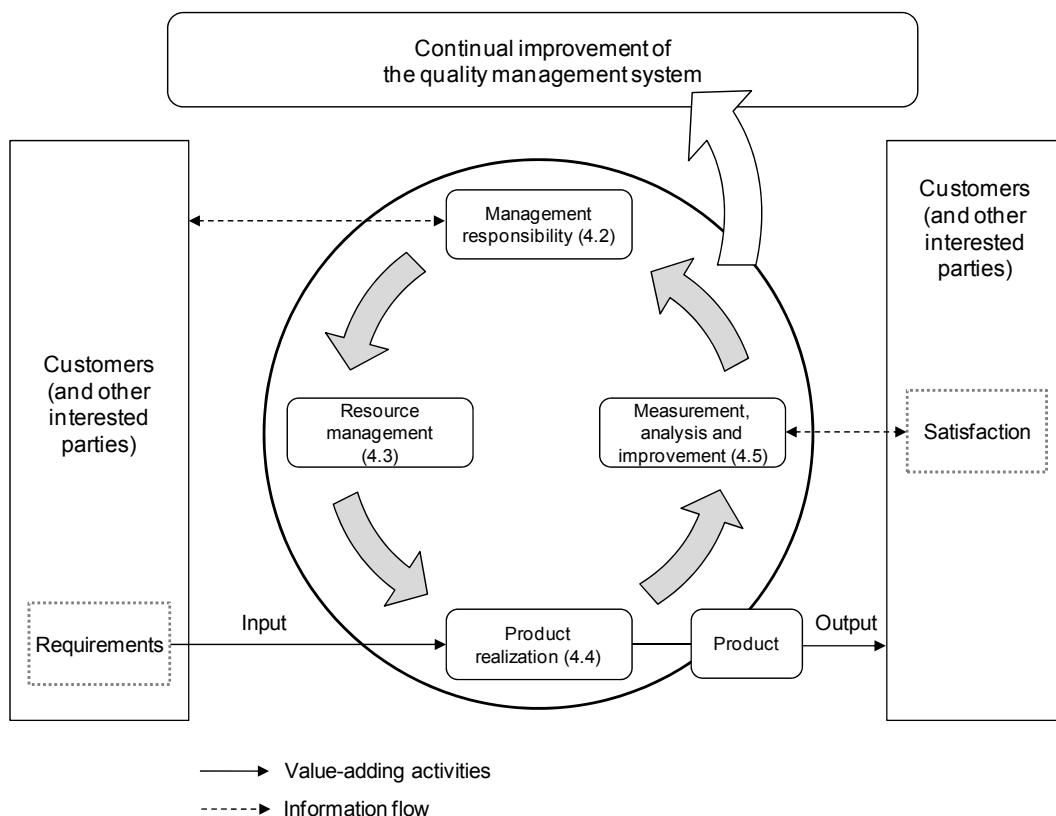

Figure 1. Model of a process-based quality management system (ISO 9000:2005, p. 9)

When applying the ISO 9000 standards, one crucial point needs to be emphasized: The implementation of a quality management system in an organization means organizing, directing and controlling the processes and resources that determine the organization's performance. Quality management is one of the management disciplines for managing an organization [ISO 9000:2005]. Hence, not the product is in the focus of these standards, as its requirements are derived from the

customer needs, but the processes realizing this product. Requirements in respect of review content, such as the choice and formulation of the evaluation criteria as well as the question what constitutes a "good" paper, cannot be elaborated in this paper.

4.1 The quality management system in general

4.1.1 Principles described in the standard

An organization shall determine the processes needed for the quality management system, the sequence and interaction of them as well as criteria and methods needed to ensure an effective steering of these processes. These criteria have to be available for each party involved. Furthermore, the organization must secure the documentation of the quality management system (quality manual), which not only involves the statements of a quality policy and objectives, but also the responsibilities and all records resulting from the product realization. [ISO 9001:2008, p. 14 ff.]

4.1.2 Application on the review procedure

The parties involved when hosting a conference are:
- the Design Society,
- the organizing team,
- the authors resp. prospective conference participants and
- the reviewers.

A variety of processes can be derived that can be considered as interaction between or within these parties. The processes to determine the effectiveness of a review are:
- choosing the reviewer(s),
- distribution of the papers,
- review the paper,
- submit review result,
- hand out review to the author and
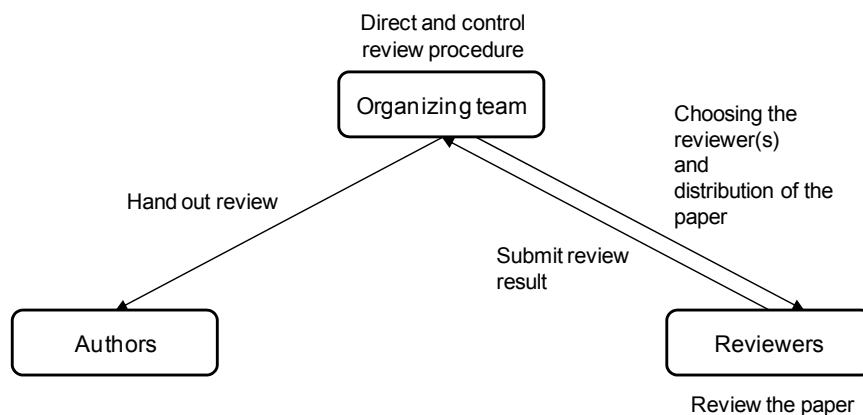- directing and controlling the review process.

Figure 2. Processes that determine the effectiveness of a review

It is obvious that there are a lot of other processes and activities between and within these groups. But the authors of this paper consider only the processes named above to have an impact on the quality of the review procedure or the review itself.

The Design Society needs to organize, direct and control these processes in accordance with the principles of quality management. The formulation and documentation of the quality objectives is crucial: The requirements for the review procedure have to be set out in writing and allocated to all parties involved. All parties contributing to the review procedure have to affirm their commitment. Such a quality manual also must contain guidelines describing the procedures shown above.

4.2 Management responsibility

4.2.1 Principles described in the standard

Top management of the organization must affirm and communicate its commitment to the development, implementation and improvement of the quality management system. Establishing the quality policy and ensuring and controlling the effectiveness of its implementation shall also be the task of the management. Moreover, it has to ensure that customer requirements are determined and met. Top management shall appoint a member of the organization's management who, irrespective of other responsibilities, has the responsibility and authority to secure the processes needed to implement the quality management system, who reports to top management on the performance of the quality management system and ensures the promotion of the awareness of customer requirements throughout the organization. Furthermore, top management must promote and ensure the internal communication and review the organization's quality management system at planned intervals. [ISO 9001:2008, p. 19 ff.]

4.2.2 Application on the review procedure

The Board of Management (BM) constitutes the top management of the Design Society. According to the principles described above, the BM must appoint a member to be the quality management representative for the review procedure. This representative communicates the review quality principles, controls their implementation and reports to the BM concerning the status of the quality management as well as improvements in the field of review. Moreover, the quality management representative shall be the reference person for all conference organizing teams in respect of the review procedure and also ensures the evaluation of the review procedure at regular intervals, the improvement of the flaws detected and especially its cross-conference implementation.

Assigning a quality management representative for the review procedure does not necessarily imply that this person alone initiates all measures. Given the fact, that the members of the BM are able to only expend a certain amount of time on the work for the Design Society, alternatives can be derived: The tasks described above could be carried out corporately by the quality representative and organizers of the conferences. Also, it is conceivable that the review quality management representative is supported by a staff position, which helps implementing, steering and controlling the quality measures. Nevertheless, it is indispensable to determine one member of the BM to be responsible. By doing so, the importance of the review procedure is being emphasized which is one of the elementary principles of a quality management system.

4.3 Resource Management

4.3.1 Principles described in the standard

The organization must determine and provide the resources needed to meet the customer requirements, to maintain the quality management system and to improve its effectiveness. This principle includes human resources: Personnel performing work that affects the product's conformity to its requirements shall be competent in terms of appropriate education, training, skills and experience. Therefore, it is essential first to determine the necessary competence for the personnel described above and then, when needed, to provide appropriate training or take other actions to secure the necessary competence. Afterwards the effectiveness of the actions taken must be evaluated. Furthermore, the organization must determine, provide and maintain the infrastructure needed to achieve conformity to the product requirements. This includes building, workspace and associated utilities, process equipment in terms of hardware and software as well as supporting services, such as communication or information systems. [ISO 9001:2008, p. 23 ff.]

4.3.2 Application on the review procedure

Considering the review procedure, personnel whose actions have the biggest impact on the fulfilment or non-fulfilment of the customer needs are the reviewers. The determination of the competences required to review a submitted paper shall be conducted and put down in written form. In order to do

so, the authors' requirements for a review shall be elicited and discussed. Subsequently the referee's competences needed to meet these requirements shall be derived based on the findings. As already implemented in other journals [Groves, 2006], starting with reviewers with little experience, training in review shall be provided. Objective of the training is to impart knowledge about the requirements for reviewing on the part of the authors as well as the Design Society and illustrate the "pitfalls" when doing a review. Such training does not necessarily have to be associated with strict teaching but can indeed be realized in some kind of interactive workshop.

In order to control the effectiveness of the training activities, monitoring of the review procedure including the review results shall be implemented. Reviewers, however, cannot be regarded as regular personnel that can be supervised by the Design Society. Therefore, the monitoring results cannot be used for disciplinary measures. But they do can help to get an overview of the reviewers' performance. Also, they can be used to compile a list of those reviewers who, regardless of the evaluation result itself, have provided reviews that have a value added for the authors in terms of reasonable and constructive recommendations and those whose reviews do not meet the requirements at all.

The work of the referees should be supported in any possible way and the necessary infrastructure must be provided. Hence, a corresponding information technology shall be ensured and accessible for all referees. The online tool for evaluating the paper must be standardized which involves both the criteria used and the user interface. Moreover, the uncomplicated communication between the reviewers, the authors and the organizers shall be ensured. In the previous section supporting services for the personnel were proposed. Checking the papers before distributing to the reviewers in respect of formal quality and discarding those not fulfilling them can facilitate the reviewers' work, so that they do not have to struggle with papers written in unacceptably poor English and presented in an inadequate way.

4.4 Product realization

4.4.1 Principles described in the standard

According to ISO 9001:2008, the organization shall plan and develop the processes needed for product realization. Therefore, the quality objectives and requirements for the product first have to be determined, as mentioned before. Then the processes needed are to be organized and appropriate monitoring, measurement, inspection and test activities must be defined. The communication with the customer is essential. Product information must be accessible to the customer and customer feedback including customer complaints must be processed. Furthermore, the organization must carry out production and service provision under controlled conditions which includes amongst others:

- the availability of information that describes the characteristics of the product,
- the availability of work instructions,
- the use of suitable equipment and
- the availability and use of monitoring and measurement equipment.

In case the measurement of the production or service provision is not feasible and deficiencies become apparent only after the product is in use or the service has been delivered, all contributing processes must be validated using defined criteria for the evaluation and approval. The identification and traceability of the product is crucial in order to ensure its quality at any stage of the realization process.

The organization must exercise care with customer property when it is under the organization's control or used within the product realization process. This also includes intellectual property and personal data.

Along with the monitoring and measurement of the processes needed to realize the product, the product itself and its conformity to the customer requirements need to be evaluated. Corresponding equipment must be implemented and its use has to be ensured by establishing the processes needed. [ISO 9001:2008, p. 25 ff.]

4.4.2 Application on the review procedure

As described in section 4.3.2, when determining the requirements for a review and deriving quality objectives out of these, it is essential to survey the authors as they are the customers. In addition to that, referees and other Design Society members can be consulted in order to find out what constitutes a good review. In terms of quality management, the organization team and referees shall not only meet the requirements but also strive for exceeding them.

The communication with the author is another issue that needs to be worked on. To start with, the review procedure has to be made transparent to the authors. Giving the authors the possibility to track their submitted papers could be a service that is appreciated by them as they can always be informed about the stage of the procedure their papers currently are at. Moreover, the author should be enabled to raise an objection in case of review errors or requirements not being fulfilled (it is needless to say that the acceptance of a paper is surely not a requirement) or to give general feedback on the review.

Reviewing constitutes a service where the quality can only be assessed when the service has been completed and delivered. Hence, it is indispensable to validate the processes that contribute to that service. Given that it cannot be the intention to fundamentally scrutinize the review procedure, the current procedure shall be validated at regular intervals using defined criteria. Such criteria could be the time span between the paper distribution and the review submission or the ratio of assigned referees to those who have completed the review. A paper tracking system can enable the organizers to monitor the progress.

A submitted paper is the intellectual property of the author. Therefore, the handling with the paper and its contents has to be clearly specified.

Another instrument for quality assurance is the continuous measuring and testing of the product. In case of reviewing it is not feasible to conduct these measures while the paper is being reviewed. Also, it is not possible to control each single review. The authors of this paper suggest the papers being randomly chosen for counter-check even if they were reviewed by two referees. The awareness that their reviews could be subject of an inspection may enhance a stronger commitment on the part of the referees. A statistical summary of the evaluation results of each reviewer could be used in order to check for irregularities or noticeable results. On the one hand this could be the case of an extremely good or bad evaluation. On the other hand, the fact that a reviewer always seems to deliver the same evaluations can surely also be regarded as some kind of noticeable result. When providing the referees with the summaries of their own review results, they can be used for self-evaluation. As reviewing constitutes a voluntary work, this seems to be an appropriate way to present some kind of work evaluation without irritating the referees: The referees have the chance to monitor their own work without having the feeling of being judged. In order to realize the measurement of the review procedure, not only have the according technology to be provided and maintained, but also must the human resources for these activities be assigned. Also it is crucial that the described measurements are being implemented in all conferences hosted by the Design Society.

4.5 Measurement, analysis and improvement

4.5.1 Principles described in the standard

The organization shall monitor information regarding customer perception as to whether the organization has met customer requirements and has to process this information as a criterion for evaluating the performance of the quality management system. The methods for obtaining and using this information must be determined. Also, the organization must ensure that products not conforming to the requirements are identified and controlled in order to prevent their unintended use or delivery. When such a nonconforming product is corrected it must be re-verificated to demonstrate the obtained conformity.

Furthermore, continual improvement is one of the essential concepts of a quality management system: The organization has to continually improve the effectiveness of its system through the use of data analysis, corrective and preventive actions as well as management review. A documented procedure must be established to define requirements for evaluating nonconformities (including customer complaints), determining their causes, for assessing the need for action in case nonconformities occur

and for the records of the results of action taken. In the sense of prevention the documented procedure also has to contain requirements regarding the determination of potential nonconformities and their causes as well as the need for action in order to prevent their occurrence. [ISO 9001:2008, p. 39 ff.]

4.5.2 Application on the review procedure

The Design Society shall not only push on determining the authors' requirements for a review but also strive to gain information about their evaluation of the review performance and regard their assessment as an essential criterion for the effectiveness of the review procedure. Hence, the collection of the needed data and their processing within the Design Society must be established. One possibility could be surveying the authors at regular intervals, both authors of accepted and rejected manuscripts, and then taking them as a basis for deriving fields of action for improving the system.

In section 4.4.2 (product realization) the random counter-check of reviews has been suggested in order to measure the review quality. Based on the principle of the control of nonconforming products as described above, it seems reasonable to conduct the counter-checks before the reviews and the corresponding decisions on the participation at the conference are passed on to the authors. By doing so, the organizers have the chance to identify inadequate reviews before they are delivered. A procedure has to be defined which allows for the counter-check of the reviews as well as the identification and traceability of nonconforming reviews. In case such a review has been sent back to the referee in order to have it re-reviewed, the verification of the conformity has to be ensured after the review has been re-submitted.

All described measures have not only to be obligatory for all conferences but also must be continually evaluated and tested in order to push on the continual improvement of the review procedure. The Design Society must always look for potential improvement possibilities. Therefore, the identification of potential errors and their causes as well as the clarification of how to deal with them has to be conducted at regular intervals. In the sense of management responsibility, it would make sense to involve the Board of Management, or at least its quality management representative for the review procedure. Such a review quality workshop could be held once a year in order to determine the cross-conference strategic objectives. Also, an evaluation of the review performance after each conference should be conducted by the organizers and potential improvements derived from the flaws being detected.

In order to identify potential nonconformity and their causes as well as how to deal with them or how to prevent them, the lessons learned should be elaborated after each conference and made accessible to future organizers. That way, potential errors can be identified out of experiences being made and their occurrence may be avoided at the next conference. All collected information and gained knowledge can be saved and processed in an online platform which is accessible to all organizers and other involved parties.

5. Conclusions and further steps

The measures described in the previous sections have been derived by applying principles of the ISO 9000 standards on the review procedure of the Design Society. They can help to secure, maintain and improve the quality of the review procedure and the review itself. In this sense, a review can be regarded as the product whose customer requirements oriented realization can provide competitive advantage. As stated before, the Design Society surely cannot be considered as a business company. Therefore, when applying the quality management principles, restrictions must be taken into account. These restrictions have been, when relevant, pointed out in the sections above. They can be ascribed to the fact that the members of the Design Society, the local organizers as well as the reviewers all engage in the review procedure on a voluntary basis. Thus, disciplinary and coercive measures shall be avoided and the motivation of the parties involved must be fostered instead.

Regarding the review of papers as a product and the authors as customers is crucial to the presented approach. Thus, this concept needs to be introduced to the reviewers who have to internalize the importance of this task. Reviewing shall no longer be considered as some kind of must. This cannot be triggered by coercion but has to be achieved by other means. One possibility could be to provide adequate payment for the review of a paper. But given the fact that it surely is not possible to pay all

reviewers needed for a conference, this seems not to be the appropriate way. In order to emphasize the value of reviewing, it is more effective to recognize the referees' work. Many journals, such as the Journal of Engineering Design, publish the reviewers' names annually. The British Medical Journal even invites the reviewers to a party at which the best reviewers of the year are awarded. Certificates that document the review experience are provided [Groves, 2006]. All these measures can also be implemented within the Design Society: When giving awards for best papers, why not awarding the best reviewers? By recognizing a reviewer's work and emphasizing the value added for each party, maybe one day review engagement will be based on intrinsic motivation.

The next steps to take would be to elaborate a detailed guideline or review manual containing the quality objectives and all principles shown above. For this purpose, it is indispensable to bring authors, reviewers, organizers and top management of the Design Society together in order to include requirements of all parties involved. To start with, it could be helpful to implement the principles in selected fields and then to refine the system stepwise instead of introducing a whole new system at one blow. As mentioned before, referees are not regular personnel and avoiding irritations is crucial when implementing quality management rules in this field. Nevertheless, realizing the described measures and exploiting the improvement potentials could help the Design Society to become best in class as to review procedure.

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