Quality Function Deployment (QFD) for Global Competitiveness in Product Development Using ISO 16355

Glenn Mazur, QFD Red Belt®
QFD Institute (USA), International Academy for Quality
glenn@mazur.net

Nicklas Bylund, Ph.D. QFD Black Belt®
Sandvik Coromant

Abstract
There are approaches to improving a company's new product development process by improving bits and pieces, but a more thorough impact is accomplished with a chain of well integrated methods in an educational package including certified skill levels. The ISO 16355 Applications of Statistical and Related Methods to New Technology and Product Development is such a package. QFD is used by companies to better understand spoken and unspoken customer needs and their priority, and then translate them into product requirements, assuring quality throughout the design, manufacturing, and after-sales phases. The traditional QFD tool set focuses on time consuming matrices, called houses, but in today's lean businesses, the resources available to do this depth of analysis are reduced. Furthermore the matrices have often overshadowed the true soul of QFD, i.e. drive customer needs through the whole process. More efficient methods have been introduced by the QFD Institute under the guidance of Dr. Yoji Akao, the founder of QFD. For a manufacturer with a worldwide presence, especially, translating the voice of the customer was found to take on cultural in addition to linguistic imperatives. This paper will focus on the going to the customer's gemba (or machine shop in our case), one of the methods in modern Blitz QFD® methods and discuss the differences of applying gemba in different cultures where Sandvik Coromant is active.

Keywords
Needsdiscovery, QFD, gemba, product development, cutting tools, ISO 16355

1 Introduction

Sandvik Coromant is a leading manufacturer of metal cutting solutions with worldwide presence. The main products are drills, turning and milling tools with interchangeable coated tungsten carbide inserts. The company has put forward a goal to reduce by half the time from identifying customer needs to achieving peak sales. The company has had a long history of innovative products which has been the key to the firm's success. Shortening the lead time while still offering innovative products is seen as the way to increase earnings even more. Blitz QFD® (ISO 16355-2, -4, and -5) from the QFD institute has been used in two development projects to see the impact on achieving this goal. This paper aims to describe how gemba visits to the customers have been performed and the experiences learned in adapting the process to different cultures.

1.1 ISO 16355

Part 1. General principles and perspectives of the QFD method (ISO 16355-1). This overview describes the general framework of QFD and suggests various methods and tools with relevant references and examples.
Part 2. Acquisition of VOC/VOS – non-quantitative approaches (ISO 16355-2). This part details how to identify and acquire the voice of customers and stakeholders through visits, interviews, and inference.
Part 3. Acquisition of VOC/VOS – quantitative approaches (ISO 16355-3). This part details how to identify and acquire the voice of customers and stakeholders through structured surveys and interpretation of statistical information.

Part 4. Analysis of non-quantitative and quantitative VOC/VOS (ISO 16355-4). This part takes the acquired voices and translates them into customer needs which are then prioritized and competitively benchmarked to determine satisfaction targets.
Part 5. Strategy and Translation of VOC into engineering solutions and cost planning (ISO 16355-5). This parts translates the customer needs into engineering requirements in order to develop a solution strategy that accounts for quality, new technology, reliability, and cost concerns.
Part 6. Optimization – robust parameter design (ISO 16355-6 and ISO 16336). This part, first independently published as ISO 16336, addresses design phase optimization of nominal value parameters based on robustness of function.
Part 7. Optimization – tolerance design (ISO 16355-7). This part addresses when to tighten tolerances to improve overall product quality and performance.
Part 8. Guidelines for commercialization and life cycle (ISO/TR 16355-8). This technical report will address quality issues related to post-design test, build, package, commercialize, support, service, and retire from market phases.

1.2 Quality Function Deployment (QFD)

QFD was developed in the 1960s by two Jpaanese members of the International Academy for Quality, Shigeru Mizuno and Yoji Akao, as a method to assure quality and customer satisfaction with new products. The concept was that if engineers understood "why" customers wanted certain product features, they would be better able to assure satisfaction in their various modes of use. This required that engineering gain more intimate knowledge of consumer and user behavior as well as their words. This type of insight required actually visiting customers during their work (business to business) or home (business to consumer) type products. Based on these "gemba" visits to the place where the product is used, engineers would be able to offer better solutions to customer needs. Over the years, the methods and techniques have grown to handle products, services, information technology, and even internal business processes. These methods are explained in the guidance sections of ISO 16355.

The QFD institute, put forward that true QFD, either Blitz QFD® or traditional QFD, does not require the use of matrices - it is about driving quality throughout the whole process; with quality defined as providing usefulness to the customer. It is also about aligning the effort of every part of the organization to contribute to satisfying the customer needs. In fact, the Japanese translation of QFD means that quality (as defined by the customer) must be deployed across all relevant business functions. Thus, there can be no QFD without a customer focus. From above reasoning it is evident that it is critical to find and prioritize and create a common understanding of the customer needs throughout the company. This paper describes how this is achieved by using the gemba method.

2Research and implementation methodology

Mr. Mazur trainer from the QFD Institute trained two development teams with the other author,Dr. Bylund and Mr. Wolf (mentioned in the acknowledgment section)acting as facilitators helping the teams with applying the Blitz QFD® methodology between the two training modules as well as participating in gemba visits throughout the world. The research methodology adopted to perform the study and the change in product development practice was Participatory Action Research (PAR). The two facilitators participated as product developers during the implementation of Blitz QFD® in two pilot projects while at the same time reflecting on the impact of this implementation and keeping a continuous dialogue both with Mr. Mazur and the team members regarding the content and adaption of Blitz QFD®.

2.1 Success criteria and measurable criteria

The ultimate goal or success criteria of the change in product development practice is to reduce the lead time from finding customer needs to peak sales and satisfied customers. Furthermore, to stay competitive in the long run, solutions that satisfy customers should be innovative and patentable. To actually measure the impact of a process like Blitz QFD® on the above ultimate goal is difficult; first, the time span that should be reduced is long, several years, and second, other factors like business climate and competitor's moves also have a great influence. The concept of measurable criteria from the Design Research Methodology (DRM) proposed by Blessing and Chakrabarti is used here. The

idea behind the DRM is to establish a plausible link between success criteria and measurable criteria. The effect of a change on measurable (sensible and proportional to the actual change) criteria can then be seen and conclusions regarding the success criteria drawn at an earlier stage. The measurable criteria in this twin case study consisting of two full size pilot cases are based upon experience from earlier product development projects at the company. The following measurable criteria have had a beneficial effect on lead time and innovative solutions:

1. A shared and deep knowledge of the customer needs and their priority will align the development efforts and reduce wasteful activities (i.e. developers designing to satisfying different needs, designing to fulfill things that are not needed).
2. Shared knowledge throughout the organization of what the customer need and understanding of the conditions of use aligns the development as well as introduction and sales efforts.

2.2 Pilot projects

Blitz QFD® was tested in two full size product development projects at Sandvik Coromant which is needed to see if a new process has the potential to improve practice in a large company. The core project teams for each of these two pilots consisted of eight persons from the product development organization, two from production, one person representing marketing, and one project leader for each project. The Alfa project dealt with a hole making solution based on tungsten carbide drills. The project was in its early stages and hence it lent itself very well for being a Blitz QFD® pilot. The main focus of Alfa was to find the customer needs and their priorities, hence the first stages of the QFD process were most appropriate. The Beta project was about the design of a threading turning system based on interchangeable coated tungsten carbide inserts. This project was to adapt an existing system to a smaller insert so the solution was very much decided by the existing system design. Because the status of the project had already been moving forward, it was too late to expect big changes from implementing Blitz QFD® or any new process changes. This late startrisked adding bias when gathering customer data visits.

2.3 Custom tailored Blitz QFD®and gemba process

As earlier mentioned, Sandvik Coromant has put forward a goal to reduce by half the time from identifying customer needs to achieving peak sales. The QFD Institute first made a technical diagnosis of our product development process by interview key process owners. These included senior managers from cutting tools development, drilling and boring tools development, insert production prototypes, metal cutting research, product management for drilling and boring, project management office, product application, R&D, cutting tool production technical development, and CAE systems/support. Based on the “voice of the company” a preliminary adaptation of the Blitz QFD® process was custom tailored into a subset of methods that would comprise Sandvik Cormorant’s minimum QFD effort. See Figure 1 for a flow chart of this tailored QFD process. One quick reference guide and two extensive course binders with examples from other industries but also with realistic examples from the area of metal cutting was used as materials in the Blitz QFD® training. The training at the company consisted of an orientation QFD Gold Belt® briefing for top management, the basic QFD Green Belt® course for classroom training of the tools, complete with a quick reference guide, and the complete QFD Black Belt® course using the comprehensive body of knowledge binders to develop future facilitators and trainers within the company. A core principle of Blitz QFD® is that there is no one-size-fits-all technique and that the methodology’s tools and flow should be adapted to the needs of each company, much like proposed by Meissner and Blessing [8]. It is typical for an outside trainer to facilitate the first project and simultaneously train dedicated internal people who will continue to apply Blitz QFD® on additional projects.

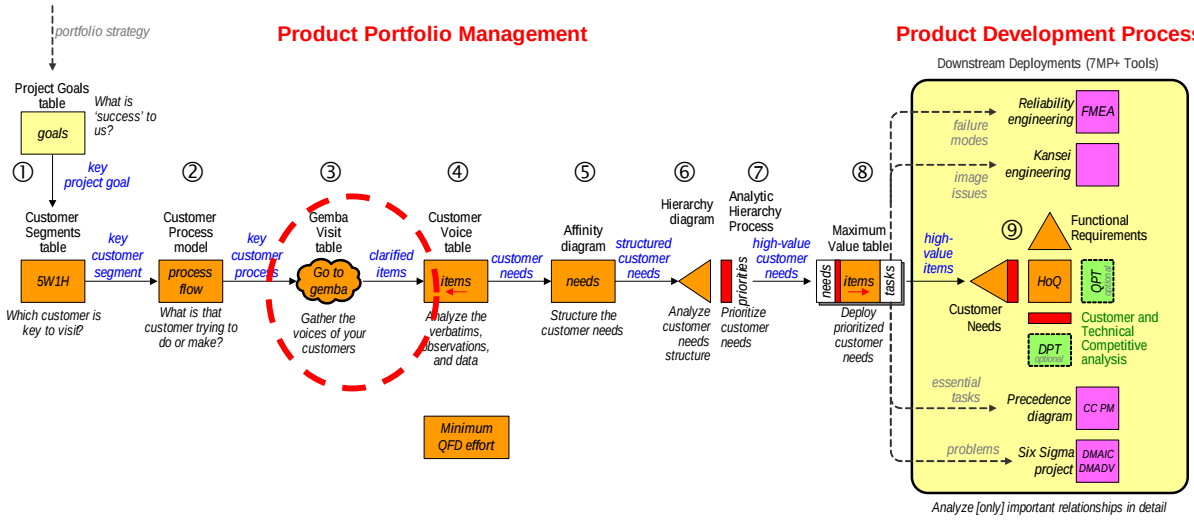

Figure 1. Sandvik Coromant's custom tailored Blitz QFD® process.

2.3.1 What is *gemba*

In the following sections, a brief description of some of the tools in Figure 1 will be described, with particular attention paid to step 3, customer visits. Conducted properly, a customer visit can produce an enormous, though still manageable amount of data. The method unique to Blitz QFD® is called "going to *gemba*" what the Japanese call the crime scene. To learn how to perform customer gemba visits on safe ground a number of visits were first practiced within the Sandvik group in Sweden with one of the authors' guidance. This paper will concentrates on the gemba visit; shown in the red dotted circle in Figure 1.One of the principal strengths of the QFD process is that the output of one method is consistent with the input to the next, hence the information about customer needs found at the *gemba* visit is preserved and becomes the basis for the solutions.

2.3.2 The *gemba* process

Gemba is not unique to QFD in that it is a long-standing kaizen process in Japanese Total Quality Management. [9]This technique is one of the three *gen*s shown in Figure 2 that describe how to get facts and data in order to achieve real improvement. In most TQM, six sigma, and lean practice, this is done in our plants or shop floors in order to improve our existing products and processes. That is, traditional *gemba* visits are internally focused on our operations and people.

現場	*genba*	actual place
現物	*genbutsu*	actual thing
現実	genjitu	actual fact

Figure 2. The 3 gens.

When using QFD to develop new products, however, there is no internal *gemba* at this point because the product has not been designed or developed yet. The functional requirements are not defined, technology is not yet developed, manufacturing steps and materials are not yet determined, so there is no internal *gemba* to see. Thus, in Blitz QFD® *gemba* shifts from our internal operations to the customers' operations so we can see what problems and opportunities the new product needs to address. Blitz QFD® includes a well developed set of tools and methods to assist in this analysis. A QFD Red Belt® custom tailoring QFD for an organization should adapt these tools to these needs of the company, the products, and as this paper will explain, the customers themselves. For Sandvik Coromant, the flow of these tailored tools is indicated in steps 2-7 in Figure 1.

2.3.3*Gemba,* a different mindset

Traditionally customer visits at Sandvik Coromant have been taken care of by sales personnel and technical specialists, and then later in the project by development engineers bringing samples for field tests. At first there was certainly skepticism among some development engineers to go to the customer without having any prototype to show or test. Since the trial*gemba* visits performed in-house, however, a more positive attitude towards *gemba*has become prevalent. *Gemba* is truly a different way of looking at things. In traditional sales calls, the primary responsibility was to introduce new products, take orders, maintain the relationship between Coromant and its distributors and with their customers' purchasing agents and shop floor operators.

In *gemba*, the sales personnel have to arrange the visits by our product development team members, explain to dealers and customers why we are coming and how this will benefit them when the new products come out, and very importantly, to act as a language and cultural liaison and translator/interpreter during the *gemba* visit. It is critical that sales personnel, who earn their income based on what they sell and instinctively want to turn the *gemba* visit into a sales call, resist this and become a conduit of information from the distributors, purchasers, and operators. Any selling pressure will sour the data gathering purpose of *gemba* and any bias they introduce will reduce the quality of what is learned.

Technical specialists are usually called to the field to address special materials or machining requirements, address problems reported by customers, and to provide training for new products being introduced. In other words, their focus is on applications of existing products to new conditions, rather than new product development. They can be valuable *gemba* players, however, because they can bring back to developers information about trends and changes in materials, metal working machine capabilities, new requirements or tighter specifications demanded by the customer's customers (like automotive engine manufacturing plants, for example), etc. They should be trained in the *gemba* process for this purpose.

Product development engineers who feel naked without a prototype to show or test must learn how to use all their senses to better understand what customers want before they do design. They must seize the opportunity to learn about the customers operations before dimensional requirements and tool chemistries are set so that prototypes are used to validate that design was done correctly rather than to test for problems before the next prototype is developed. To train these various personnel for gemba visits, what was needed was some procedure they and the customers could easily follow – a *gemba* visit guide.

2.3.4 The *gemba* visit guide

The idea for a guide that anyone regardless of their language or background could understand emerged from the New Lanchester Strategy books introduced to Sandvik by the authors. In this series, the author uses a graphic novel (comic book) format to explain complex business strategy and mathematical formulae so they can be easily learned by front line employees. Sandvik Coromant commissioned an art bureau that specialized in this style(called *manga*in Japanese), which is shown in Figure 3. The aim of the guide is to provide a quick overview and reminders of key activitiesneeded to perform *gemba* visits for development engineers, sales personnel as well as for the customer to be visited. The guide is emailed to the customers to be visited prior to the visit as well as brought in paper format at the visit. The guide was printed in Swedish, English, French, German, Portuguese, and Italian which showed both how serious we were of the initiative as well as improving the communications. Unfortunately, timing did not permit a Chinese version – it would have been invaluable.

2.3.5Customer Process Model and the first steps when going to *Gemba*

Of course having representative customers from key segments willing to accept a visit from the product development team is crucial to performing meaningful QFD. In Sandvik Coromant's case the local sales personnel were the door openers. The *gemba* method has to be sold twice, first to the local sales personnelin the market region and then by them to the end customers or in some cases via a distributor. Before going to gemba it is valuable to try to diagram our best hypothesis of the customers' proc-

ess. This serves several purposes. First, it brings together the varied experiences of the team members. Even those with field experience (they may have been a machinist before coming to work for Sandvik Coromant) may not be up-to-date with the current best practices in the industry. Also, different team members will have familiarity with different parts of the customer's processes; rarely does one team member understand it fully. Second, most customers get impressed that instead of making a traditional sales call, the visitors have actually tried to think about what the customer does in his everyday job. The Customer Process Model (CPM) proposed does not need to perfectly reflect the customers process in the beginning as most customers will, after having said they are impressed by the effort, immediately start to correct the process. In that way, a lot of valuable information is gathered that might not have been found just by asking straight out questions. In fact, it often makes sense to build some "error" into the hypothetical process model to instigate the customer to jump in and take ownership of the *gemba* visit, rather than remain a passive interviewee. Third, by having a defined process to guide this part of the visit, the risk of getting stuck on a single issue during the entire visit is mitigated. After going through and revising the customer process model (CPM) together with the customer, failure modes (FM) to be prevented and failure effects (FE) to be mitigated can be annotated, since they give valuable information about what to investigate more in detail during the workplace visit.

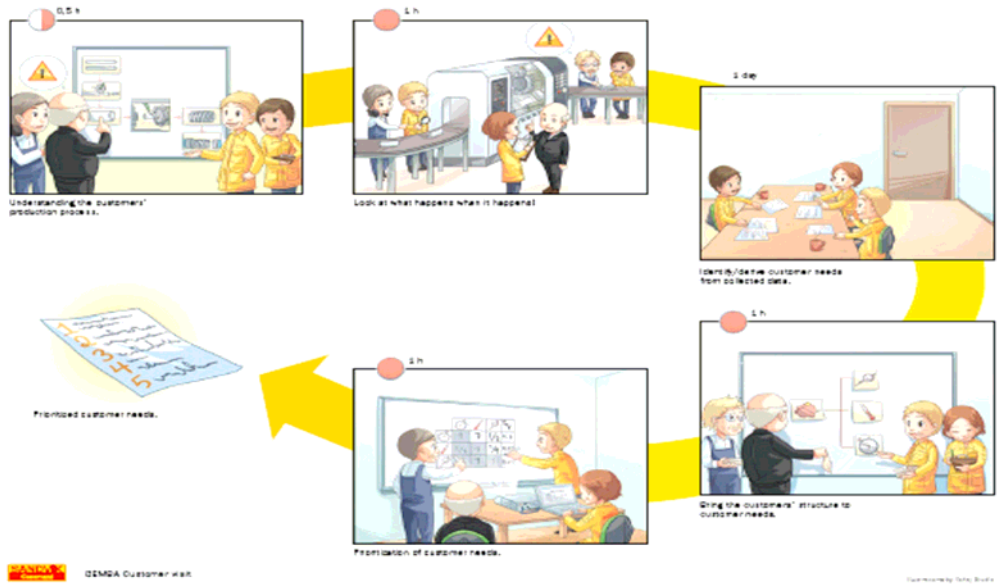

Figure 3. Sandvik Coromant's gembavisit guide.

Pilot project experiences

According to themarketing department, to arrange any kind of customer visit, it is mandatory that the responsible salesman make contact with the customer and also participate during the visit, since he or she is the one with the long term relationship with the customer. Each of the pilot projects had slightly different approaches in preparing and going to *gemba*. In the Alfa project, the marketing member of the team needed up to eight weeks to find salesmen to contact representative customers from the different segments and international markets and get them to agree upon a visit. The Alfa team prepared the salesmen that should be involved with a two-day introduction to Blitz QFD® which included a "test *gemba*". The experience of that is that a two-day introduction is short, partly because we were still QFD novices ourselves. There should either be just an explanation of how much time is needed at the customer's site (taking into account any language barrier), or a QFD Green Belt®for salesmen education (when language barriers exist between the team and customers) possibly with an extra day of training on affinity diagrams and hierarchy diagrams (described later). The Customer Process Model was considered easy to do, and it was a good instrument to get the customer to talk. There were exceptions where some sales people had not understood the purpose of getting the customers to talk and instead talked themselves, and it was hard to intervene because it was in a language not understood by the Alfa team members. The Beta team decided not to invite the salesmen in beforehand. A clear advantage for the Beta team was that their facilitator was multilingual and could speak directly to the customer in the visited markets without any bias from translation. By going step by step through the

process, unexpected findings were made which might not have been found if the focus had been immediately put on the cutting tool, e.g. the uneven quality of raw materials. See Figure 4 for an example of the Beta team CPM.

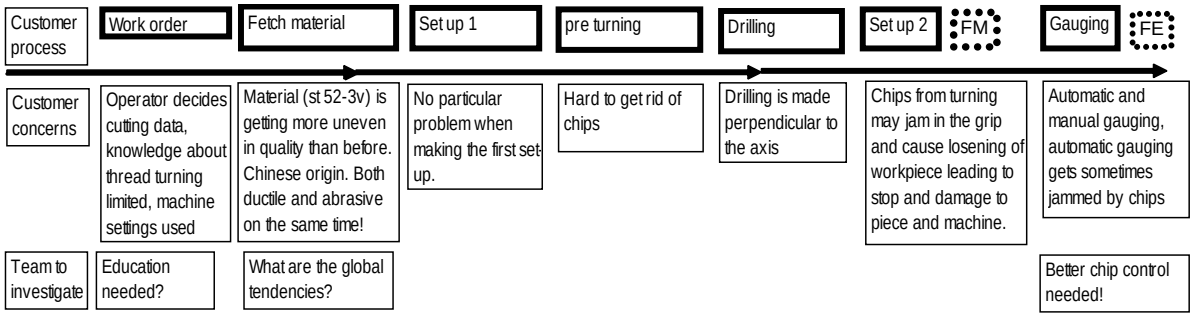

Figure 4. Example of Customer Process Model from the Beta pilot.

2.3.6 Gemba Visit Table

When the Customer Process Model has been gone through, it is time to visit the actual workplace of the customer to see where his most critical jobs gets done. These are usually associated with the customer's failure modes [FM] or effects [FE] shown in the CPM, but they could also be upstream, downstream, or even on some parallel process. Usually in the review of the CPM, the customer can explain where in their process they are having the most difficulties in quality, cost, or delivery commitments.All sources of data are to be considered: visual observations can help identify workarounds and anomalies,touch can detect vibration, variations in surfaces, deformations, etc., sound can include direct utterances by the operator (complaints, wishes) and indirect utterances (cursing at a problem) as well as abnormal sounds indicating machining or processing problems, etc., smell can direct attention to unsafe conditions, improper cooling fluids or other materials, etc., and even taste can be included in some types of products such as foods. Be sure to look for things that do not belong as well as what is not there, too. To capture this wide array of data the Gemba Visit Table (GVT) is helpful. Its purpose is to annotate observations, refer to relevant documents or manuals used at the workplace, note physical specimens provided by the customer, write down verbatim i.e. comments from the customers visited. All this data is then to be translated into measurable, clarified items. The clarified items are single-issue statements to clearly reduce complex data gathered during the visit. Team interpretations can be confirmed with customers and included, as well. It is beneficial if the customer is able to give their way of measurement and a desired target value to these items since that would make later evaluations of design solution easier. If the customer allows filming or recording at the customer's workplace is a good complement to the GVT. Nondisclosure concerns (from both sides) can be agreed upon, visual recordings can be left behind, and other techniques can be employed since a picture or video can be viewed by others, slowed down, etc. to reveal things missed the first time.

Pilot project experiences

The GVT was printed out on several A3 size sheets for the team to take notes down on during the workshop visit. It was an effective way to collect verbatim and observations when voice recording was forbidden. The GVT worked as a guide during the visit, was found to be really an easy tool to use, see Figure 5 for an excerpt showing just one row of notes to demonstrate what data goes in what column.

Gemba Visit Table

Interviewee:	Operators and technicians			**Interviewer(s):**	Mr X and Dr Y
Place:	XXXXX, Sao Paulo, Brasil			**Date and Time:**	May 14, 2008 , 12pm-16pm
Contact info: through Mr Z at Sandvik do Brasil					
Interviewee Characteristics (*memorable):	Very dynamic and outspoken (this is used to make it easier to remember the interviewee)				
Environment:	threaded tube production plant				
Process Step	**Observations**	**Verbatims**	**Documents**	**Notes**	**Clarified items**
Threadening	**Uses uncoated inserts.**	**Fast delivery of special important!**	**Drawings on site**	**Value of tube very high in comparison to insert.**	**Fast delivery of special essential (weeks)**

Figure 5. Example of Gemba Visit Table from the beta pilot.

3 Multi-cultural differences in gembas

How*gembas* are perceived and the difficulty in perform them depends on the culture in which they are performed. What is culture? One definition by given by Dr. Geert Hofstede of Maastricht University [19] is “Culture is the collective mental programming of the people in an environment” and more explicitly, “Culture is the collective programming of the mind that distinguishes the members of one group or category of peoplefrom others.” It is important to recognize that the variability among individuals within the same culture can be vast. To Hofstede, if variability among individuals within a culture is likened to abell curve, then thedifferences between cultures is like a shift of the bell curve.This variability among individuals means that the use of generalizationsregarding cultural dimensions needs to be made with great caution and not applied to individuals. It can be assumed that the smaller the set of generalization the safer it is to apply, i.e.there can be a small set of basic cultural habits that most individuals within a culture share. An example would be the way people greet when meeting, the way time and deadlines are respected, meeting manners. While more personal traits like outspokenness, shyness, drive and stamina could be assumed to vary more among individuals.

In order to classify cultures several criteria or dimensions have been proposed throughout the years by Parson and Shils [20], Kluckhon and Strodtbeck [21],and Hall [22] as well as the aforementioned Hofstede among others. Hofstede’s work is seen as seminal byDe Cieri and Dowling:“The seminal work by Hofstede has inspired much of the cross-cultural research activity since 1980 and has been the dominant research paradigm in cross-cultural studies of national attitudes for some time.” Hofstede’s work originates in a study made from data from IBM and has been validated in various studies. Originally, Hofstedesidentified four dimensions but after research by Michael Harris Bond a fifth dimension was added, the LTO (long-time orientation). LTO indices are not available for all countries but are shown at the webpage: http://www.geert-hofstede.com/hofstede_dimensions.php. Asian countries have the highest LTOs while the U.S. and some African countries have the lowest LTOs. European countries score in the middle.Hofstede’s dimensions are:

1. Power Distance Index (PDI), this reflects the unequal distribution of power in society and how tolerated it is by subordinates

2. Individualism (IDV), are people acting mostly for their own sake or is collectivism valued

3. Masculinity (MAS), this deals with the distribution of roles between the sexes

4. Uncertainty Avoidance Index (UAI), relates to the tolerance for uncertainty and ambiguity

5. Long-Term Orientation (LTO), is long time or short time thinking valued.

While, the values should be used with great care, they can serve as a first indication before going to *gemba*and a reminder that the reactions to *gemba* can differ between cultures. They can guide us when establishing the first contact with the sales personnelwho are essential for introducing the teamto any company that will be visited.As Hofstede suggests the dimensions are constructs developed for “handling the complex reality of our social world” and can act as a framework to look at cultural differences for comparing the*gemba* experiences in different cultures.

Hofstede was introduced to the QFD community by Dr. Georg Herzwurm in his keynote presentation at the 2008 North American Symposium on QFD in Santa Fe New Mexico. While Herzwurm explained the implications of how QFD teams would interact internally in different cultures, the authors felt there was value in applying Hofstede’s indices to external interactions with customers in the *gemba*.Our experience in the various*gembas*was that that the PDI (power distance) and the UAI (uncertainty avoidance) had the largest influence, and to a lesser extent also the LTO (long term thinking). We believe that the PDI can influence the way visited customers behave during a visit. In a culture with a high PDI it is suggested that subordinates would avoid expressing an opinion that differs from their superiors. To successfully perform a *gemba*visit in a high PDI culture it is important to show

integrity and in at least part of the visit, speak to different hierarchical levels separately. When we practiceda test gemba at Sandvik, we had one of our teamspeak to the machine operator while the other spoke to the technician out of hearing range from the former. PDI does not only depend on hierarchical level but also age or time with the company. A young recently employed operator might not want to speak openly in front of an older machine operator in a culture where respect for the older and more experienced is important. As with hierarchical levels,careful conduct during the visit can mitigate these effects and better information can be gathered.

The UAI can also influence the way a *gemba* visit should be conducted. A culture where UAI is high is often run by rules and regulations and traditions can be very important; unorthodox behavior is to be avoided. A customer accustomed to a regular sales call or a field test of new products can feel insecure when asked to take part in a new kind of visit such as the *gemba* visit. Cultures high on the UAI not only are more bound by tradition, they also avoid ambivalence of any kind. When performing *gemba*visits in such a culture, the *gemba* team must express full confidence and show that they are in full command of how to conduct the visit in a professional way. They must exude confidence that while this might be new to the visited company, it is a well established method. A culture high on both PDI and UAI is thus bound by tradition and hierarchy and may present a barrier to *gemba* visits. In such a case, perhaps it is better to have only one or two QFD team members join in a "traditional" sales call in order to build a long-term relationship more conducive for a future *gemba* visit.

LTO also affects gemba practice but the authors believe somewhat less. If the LTO is very low there is an expectation of rapid payback to every activity. A *gemba*with the purpose of gathering customer needs for next generation products is a long term activity, so a company in a culture with very low LTO might think it is not worth the effort to think in such a long time span and hence refuse to host a *gemba* visit. Possibly companies in such a culture could be better visited for product updates or improvements to current products. Efficientlyran gemba with clear objectives would be important in this case as well as being able to offer quick fixes should the customers raise any current product or process related problems. In this study, we did not encounter any concerns that the gemba was seen as too long range, whether the U.S.with the lowest LTO or China with the highest.

In our examination of the countries where we performed *gemba* visits, the following tendencies seen by the authors are presented.In addition to the cultural variations, there were also variations between companies within the same culture. The ownership of a company also has an impact on its culture. If the ownership is total and there is active management by the owners, cultural differences might affect the *gemba* visit differently.

There are also similarities. Regardless of the culture, the sales representative should always participate in the *gemba* visit since theyare the person with the long term relation with the customer, and will be there both before and after the visit. It should be noted that the Hofstede's indiceswere researched after the initial *gembas* were visited and are now being examined as beneficial to future visits.

3.1 Germany

According to Hofstede, Germany's indices compared to world averages are:PDI (35/54) and UAI (65/62).Compared with US indices, Germanyhas a slightly lower PDI but a clearly higher UAI (65) than the U.S.'s (46). With respect to Sweden were Sandvik has it main office, the German PDI (35) is slightly higher the Swedish PDI (31) and the German UAI (65) is much higher than the Swedish UAI (29). The indices are a relative measure which means that the difficulty in performing a *gemba*visit relates to the difference in the index score. As mentioned earlier,a high UAI implies that the professionalismof the *gemba*team is key, i.e. the way the gemba is performed needs to be without hesitation and the team well focused and trained. Our visits in Germany corroborate these indications. Sales personnel showed concerns about team member conduct since we were new to the Blitz QFD® process. They cautioned that their customers expect the manufacturer to be expert and any ambivalence or uncertainty about the product should be avoided. It is therefore important to be very clear when explaining the purpose of the *gemba* visit - that while Sandvik Coromant has the expertise in developing tools, the customer has the expertise in their process and needs. The German PDI being slightly higher

than the Swedish would imply that there is a German preponderance for hierarchies and a higher reliance onauthority than what the Swedes are accustomed to. Thiswas corroborated although our experience was that the difference in power distance is much higher than the indices indicates.

Another example of how tricky intercultural communication can be is that when speaking their mother tongue,Germans in a professional setting almost exclusively,sometimes even after years of knowing each other, continue to use the title of their colleagues such as Herr or Frau, or Herr Doktor if the person holds a PhD, followed by the family name. Swedes speaking their mother tongue uses first names and no titlesregardless of hierarchical level, education or situation. People from U.S. use titles but quicklyswitch to first names. This meant that when communicating with Germans in English, should we adopt the American style and use first names, or retain the German style of titles and family names? Swedes, having no tradition of titles to fall back on,quickly started using first names. The high UAI of Germany would suggest that if the *gemba*is not beingrun in German, the best thing is to sort this issue out at the beginning of the *gemba*visit by just asking "titles or first name" hence avoiding uncertainty!

The differences in how the *gemba*visit was performed differed a lot between companies visited. In a medium sized company more guidance was needed while in well known multinationals, challenging questions regarding the detaileddefinitions of customer needs in the hierarchy were frequently raised. We also noted that the English language skills varied even at big companies, so being able to perform the *gemba* visits in German would be a big advantage. While Hofstede does not directly address the issue of punctuality, our experience was that even being a few minutes late is unacceptable. Lead times to secure an invitation for a *gemba* visit should also be planned with adequate notice.
were to be avoided, the facts were not. Visits generally started on time and stayed on schedule.

3.5 China

Hofstede's indices for PDI (80/54) andUAI (30/62) respectively,suggests that hierarchy is important and that the acceptance for ambivalence and the unproven is high. The team was received with great openness at the companies, typical of low UAI. The team did not report any signs of the high PDI this might be because it was masked by other cultural differences. That is, signs of hierarchy might not be that easy to spot in a different culture.However, other experiences suggest that workers were apt to behave differently when supervisors were present, and so future visits will keep this in mind. This is because decisions tend to be made within the context of a hierarchical decision and so contradictory opinions might imply that the personnel might not be in sync with decisions they were expected to support. Conflicting data might tend to be hidden or ignored, and so the *gemba* team should make note of observed anomalies and investigate them in the context of seeking to understand rather than challenging individuals.

As no one on the team spoke the Chinese, translation had to be made by the local sales representative. The *gemba* team reports that what struck them the most was the lack of industrial know-how at the companies visited. By just looking at the shop several signs of this lack of know-how could be detected, such as idle machines, awkward fixturing practices, etc.Higher cutting speeds, better tolerances, longer tool life and a low purchase price werehowever put forward as the most important requirements by the customers despite huge production problems, such aspoor tolerances, piles of unfinished work in process between machinesdueto improper machining practices,and poor production planning respectively. In conversation, the customers expressed potential solutions not needs. Furthermore despite the customer's interest in shorter machining time little concern was showed for the overall manufacturing throughput.

One of our*gemba* team members put it this way,"It felt like they had put modern machines in an ancient workshop and never taught workers how to use them, instead just letting the employeesrun them as they could." It could be that these companies are not at all representative, but as in other cases, theywere chosen by the local sales representative. Further, one of the companies was owned by a well known Japanese manufacturing companywhere the use of lean principles could be expected, however whatthe team witnessed was quite different. Another company was a state owned manufacturing com-

ponent in the wind energy sector, i.e. supposedly a “leading edge business.”Strangely, the *gemba* team did not find unmet customer needs. While manyideas werediscussed, it could have been the lack of machining know-how and manufacturing experiencethat made the customer suggest solutions they thought might increase production (tool speed and feed) but that since they worked in an already well managed plant would have only minor impact.System level improvements such as overall production time and production rate were thought by the *gemba* team to be more important, so the true needswere believed to be increasingtechnical know-how by more informative documentation and education. In other words, since operators were only responsible for machine level settings such as tool speed and feed, overall process improvements and planning issues (management responsibility) rarely came up in the *gemba* visits. Visits tended to follow the predetermined schedule.

4 Conclusion

As seen from the experiences above it is hard to make firm predictions regarding cultural differences and their importance to conducting BlitzQFD® gemba visits. Tools like the Hofstedeindicesmay be frequently cited by researchers of intercultural relations, but our conclusion is that at a person-to-person level, the best way to connect to customers both culturally and linguistically is to pass through your local sales representatives and local technical specialists when they are available. However, how the QFD teamaddresses their local representatives is critical, and Hofstede’s indices can be of help. In the case of cultures havinga high PDI also the relative position between the visiting and the visited culture is important. When visiting a high PDI culture, it is important that hierarchies among visitors and from whom the visit is requestedas well asthe meeting’s importance is clear. High UAI stresses the need for very professional behavior in order to avoid feelings of ambivalence. In the end, however, the local representative’s judgment will be needed on how to best approach customers in practice.

Language barriers are not to be overlooked.In a semi-structured situation like the *gemba*where the goal is to find out as much as possible from the customers about their spoken and unspoken needs by being present in the workplace and observing activities formulating questions depends on what the situations evolve, so standard questions prepared before the visit do not work well. Furthermore, the ability to detect nuances and discrete utterances is highly dependent on language proficiency. English is not sufficient as the lingua franca during a *gemba*unless all participants including thecustomer and at least one of the *gemba* team has a high command of the language. The ability to speak the local language permits a freer exchange of ideas, even if the *gemba* team members do not speak the language perfectly. If it is possible to run the gemba completely in the local language, the local sales representative if trained in QFD and in how to conduct *gemba* visitscan take a dominant role withthe *gemba* team listening in and guiding him. If no one on the team has mastered the local language, then hiring a professional interpreter to translate is an option to keep the*gemba* team in charge of the visit. Letting the local sales representative run the *gemba*visit without direction will easily lead to deviations from *gemba* thinking (needsidentification and prioritization). To get a short statement at the end of a long discussion will not have anywhere near the same value as directly participating in the discussion that led to that statement.

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ABOUT THE AUTHORS

Glenn Mazur has been disseminating and instructing QFD methods since their first introduction into the US in the mid-1980s. His work as been recognized by the founders of these methods, receiving the Akao Prize® in 1998 and being selected as one of only two non-Japanese QFD Red Belts® (highest level) in 2000. He is also certified by the QFD Institute Deutschland as a QFD-Architekt (highest level). His positions include Executive Director of the QFD Institute and International Council for QFD, Chairman of the North American Symposia on QFD, and retired faculty of TQM at the Univer-

sity of Michigan College of Engineering. Affiliations: Senior Member of American Society for Quality and Japan Society for Quality Control. He convenor of the ISO 16355 Working Group to create the QFD standard. He is an Academician with the International Academy for Quality.

Nicklas Bylund has since his graduation in mechanical engineering from the Royal Institute of Technology, Stockholm and from ENSTA, Paris been working with product development in several industrial companies such as Volvo Car Corporation, SSAB Swedish Steel and now Sandvik Coromant. In his current position he works with improving the product development practice with respect to innovation and lead time. He has been key to introducing Blitz QFD® at Sandvik Coromant together with Glenn Mazur, having earned his fullQFD Black Belt® under his guidance.He holds a Ph.D. from Luleå University of Technology in Sweden and is active within the engineering design research community and publishing continuously.

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