



MECHATRONIC CONSULTING

SHAPING THE FUTURE BY HOLISTIC CONSULTING APPROACH



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INNOVATION MANAGEMENT

CREATIVITY AS A NEW CORPORATE CULTURE

ARE YOUR DREAMS INNOVATIVE ENOUGH?

The word innovation management suggests that innovation can be managed in a targeted manner using specified key figures. This may work for innovations that are just small improvements. However, anyone who wants to create disruptive innovations must have dreams and the firm belief that they can change the "world".

Profitability must not inhibit creativity!

As current technical developments show, Germany is very progressive in terms of iterative, incremental development.

However, traditionally positioned companies have difficulties when it comes to digitization or innovations. Groundbreaking innovations are not currently expected from German medium-sized companies.

A major obstacle here is that a culture of "being allowed to spin" and "being allowed to fail" does not prevail in companies.

Rather, the return on investment is in the foreground. New developments and creative approaches are often not allowed.

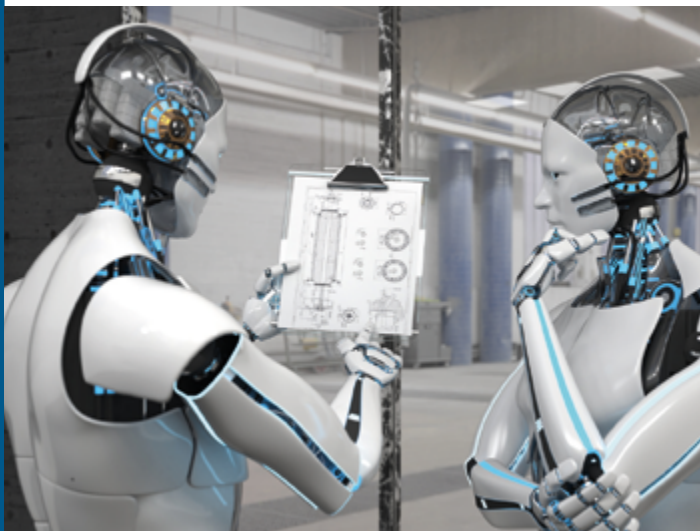


Failure permitted on the way to success!

To establish a culture of trying new things, given mechanisms and processes must be circumvented. Easier: Every now and then creativity breaks the rules.

This is almost impossible in a normal work environment. Die-hard ways of thinking and working cannot be ignored one day of the week and adhered to again the next day. In our experience, it has therefore proven useful to have teams work away from their actual tasks in a very limited time frame and to have interim results presented regularly.

A success factor is that these teams consist to a large extent of young engineers/students who are still free to think. They know the requirements of the future and are often much more familiar with the most modern digital tools than some "old hands".



APPROACH

Give the engineering spirit enough space!

It has proven particularly useful when these agile teams can initially give free rein to their wishes and dreams for the future. So-called Make-Marathons (MAKEATHONS), which last between eight hours and several days, are a very good approach to converting these ideas into the first defined prototypes. Experienced engineers are often amazed at what can

be achieved in such a short time. Particularly interesting "inventions" can then be implemented in even more extensive demonstrators. At one of the largest demonstrators that ITQ built for the VDMA, 36 students implemented a complete packaging machine in just 36 weeks. The highly innovative functions amazed a large audience at trade fairs.



"Those who are not allowed to make mistakes will stop thinking innovatively. Let's be braver! Let us allow mistakes, learn from them and implement innovative dreams."

Dr.-Ing. Rainer Stetter
ITQ Managing Director

✉ stetter@itq.de

BENEFITS

Innovation pays off!

- Identification of trends and future opportunities and risks
- Turning an idea into a successful innovation
- Realization of the first prototypes in a very short time
- Use of the most modern engineering methods
- Testing innovative technologies
- Multi-stage realization of prototypes/demonstrators
- Inexpensive and fast testing of innovative ideas
- Building agile teams
- Intelligent form of recruiting

SERVICES

Find and allow creative approaches!

- Idea management for finding, developing and evaluating ideas
- Organization of international training events (MAKEATHONS)
- Provision/search of suitable students /candidates
- Establishing contacts with universities and other companies
- Numerous demonstrators available to show possibilities
- Worldwide, broad network to companies, universities and institutions

AGILE PROJECT MANAGEMENT

PLAN SUCCESSFULLY

FOUNDATION PILLAR OF SUCCESSFUL PROJECTS

Project management represents the interface of all parties involved in a project and is crucial for the success of technical system development. Experience and realistic as well as constant assessments are the basic pillars of successful project planning that we experience.

Do projects fail due to their complexity?

Software development is still receiving too little attention in the mechanical engineering industry. Although the proportion of software functions in this area is extremely high and will continue to grow.

Underestimated complexity and scope of work packages are causes of project failure. Good and successful project management is not only characterized by the achievement of a strict and rigid goal, but also by a dynamic and agile reaction to changing framework conditions.

The development of software in mechanical engineering in particular is subject to many requirements and interfaces.



Stay agile despite concrete planning

A key competence in the development of complex technical systems - especially intelligent machines with a high proportion of software - is requirements management. It is advisable to look at facts from other perspectives and to question all stakeholders involved to enable an exchange of experience and interests and to delineate the scope of a project.

For a predictable project process, task packages are put together and a schedule is drawn up. Deviations from scheduling due to changed framework conditions are often the case. Dynamic and agile configuration and change management as well as well-thought-out resource planning provides a remedy.



APPROACH

The team is the basis

The basis for successful project management requires a thorough and concrete recording of project goals. All stakeholders must be taken into account to be able to draw up a robust specification.

In addition to formulating the common goals, prioritization is necessary so that the efforts can be achieved

profitably and gradually. The risks must be assessable at all times.

A complete project organization also includes putting together a harmonizing team that can efficiently solve problems and thus create high-quality products.



"Being involved in a project organization promotes enthusiasm for a project and creates a motivation boost for technical implementation."

Harald Weigold
Member of Management

✉ weigold@itq.de

BENEFITS

Advantages for your project

- Interface for everyone involved
- Determine the scope of services of a project
- Prioritize goals
- The project process can be planned
- Agile reaction to changing framework conditions
- Control over the complexity and scope of a project
- Optimal use of resources
- Team motivation through transparency
- Building experience through reflection
- Project success

SERVICES

We offer you!

- Efficient teamwork
- Coaching of successful methods
- Requirements acquisition
- Risk assessments
- Advice and support for the implementation of the processes
- Examination of existing structures
- Evaluation of solution approaches
- Develop a holistic strategy
- Project structuring
- Workshops for everyone involved
- Monitoring over the project period and beyond

VALUE ANALYSIS

EARLY PROCESS OPTIMIZATION

SAVE COSTS AND OPTIMIZE PROCESSES THROUGH SUITABLE ANALYZES

With mechatronic value analysis, mechanical and plant engineering has a powerful tool at its disposal, that can be used not only for subsequent optimization but also for new developments. Both, the functions of the machine and the internal processes in the company are analyzed and their impact on costs and added value is assessed, and recommendations for action are drawn up.

Development of process and product

When developing new machines and products, machine and plant engineering is faced with the challenge that costs, market prices and margins must be set long before the exact design of a machine is known. Experience and estimation methods are then used to determine the costs.

However, these estimates can quickly become obsolete in the face of rapidly changing market requirements and developments across distributed locations. Also, deviations often only become apparent late in the process - in the worst case, only when the first orders are recalculated. There is then an urgent need for action to optimize the machine, which has already been constructed and perhaps has been sold several times, in terms of cost.



Recognize long term potential!

While potentials that can be realized in the short to medium term can often be identified in functional costs, mechatronic value analysis goes one step further. Only a holistic view makes it possible to identify long-term potential.

These can often be found in the company's processes and procedures. The realization of this potential requires a consistent, mechatronic structure and an adapted engineering process.

A corresponding toolchain supports this procedure and makes the costs in the entire development process transparent and understandable so that deviations can be quickly recognized in the future.



APPROACH

Sound recommendations

The value analysis provides tools and methods to leave the local perspective and enables a holistic view of the products and processes.

In any case, an interdisciplinary team is required to analyze the mechatronic functional structure and thus create the basis for the value analysis. Only when this structure exists, costs and sales prices

can be assigned and the value of individual functions determined and optimized. In addition to the functions and costs of the product, the processes in the company can also be analyzed.

This is where long-term measures come in that sustainably improve process costs, lead times and, process quality.



"The mechatronic value analysis is more than just the material and manufacturing costs. It gives us the opportunity to identify long-term potential."

Marko Nagl
Software Engineer

✉ nagl@itq.de

BENEFITS

Enable optimal processes

- Away from many local measures towards global optimization
- Holistic view of products and processes
- Savings in material costs of 10-25 % possible
 - Consistent, mechatronic structuring of the machine
 - Transparency in the entire development process
 - Integrated controlling
 - Minimization of friction losses
 - Integrated toolchain
- Questioning functions and structures that have grown over many years
- Strengthening interdisciplinary cooperation

SERVICES

We offer you!

- Structuring and processing existing data
- Cost analysis
- Develop alternative solutions
- Creation of a mechatronic functional structure
- Conducting and evaluating expert interviews
- Continuous tracking of measures and savings already achieved
- Analysis and optimization of development processes
- Development of mechatronic kits
- Conceptual design of a toolchain for consistent, mechatronic engineering
- Development of decision templates
- Solution-neutral definition of requirements
- Benchmarking, evaluation and selection of suppliers

BENCHMARK METHODS & TOOLS

GOOD DECISIONS REQUIRE SUSTAINABLE ANALYSIS

THE AGONY OF CHOICE

If you want to be innovative and fast, you need the right methods and good tools. Which of the many different methods and tools best suit your company? Our experienced consultants help you find the most sensible solutions for you in a structured, requirement-driven benchmark.

Are you already benefitting from the competitive advantage through suitable development tools?

Innovations have to be brought onto the market at ever shorter intervals. To achieve this, cross-disciplinary engineering is imperative. You can only offer your customers an optimal cost-benefit factor if the methods and processes are chosen wisely and the tools used perfectly.

The ever increasing proportion of software in all product sectors and industries means that the field of software and control development is increasingly becoming a bottleneck in projects.

For this reason, when selecting tools, it is important to ensure that the development tools used take especially this aspect into account and help to increase the development speed in the software and automation field.



Are you still comparing or did you already decide?

The solutions available on the market can be sensibly compared using a structured, requirement-driven benchmark. Our concept provides an approach based on use cases, which enables the technical possibilities of the individual solutions to be assessed transparently.

The focus is on the degree of fulfillment of your use cases. At the same time, we sound out the solutions on the tooth and do not rely on data sheets or promises that lie in the future.

We make sustainable decisions with you based on a viable analysis!



APPROACH

Well-founded recommendations

Our employees record and document your requirements in a structured and holistic manner. Your existing processes and use cases are at the center of the selection of possible solutions and form the basis of a comprehensive analysis.

- We create a strength-and-weaknesses profile of different solutions for you based on a clear and comprehensible metric
- We explain any deviations from best practice approaches and perform initial evaluations based on the knowledge gained
- It is important to us that all steps are traceable and transparent for you
- Based on these viable analyses, you will receive well-founded and clear recommendations for action from our specialists



"Use case based benchmarks offer an excellent possibility for our customers to make transparent decisions reliably."

Anton Fritsch
Senior Consultant

✉ fritsch@itq.de

BENEFITS

How to benefit from our cooperation

- Thorough recording of your requirements
- Documented processes and relevant use cases
- Overview of existing methods and tools
- Clear metric as the basis for the evaluation
- Direct comparison of different solutions
- Strength and weaknesses profile
- Reliable basis for decisions
- Specific recommendations for action

SERVICES

We prepare your decision thoroughly!

- Preparatory measures
 - Record the status quo
 - Identify use cases
 - Common definition of your requirements
 - Define evaluation criteria
 - Provide an overview of methods and tools
- Execution
 - Identify methods and tools
 - Preselection based on your requirements
 - Examine selected methods and tools
 - Application and evaluation based on use cases
- Evaluation
 - Show strengths and weaknesses
 - Derive recommendations for action
 - Decision based on clear requirements

SOFTWARE QUALITY MEASUREMENTS IN THE PLC LANGUAGE

CODING BY ALL RULES OF ART

Code quality is a sub-aspect of software quality with which, in particular, non-functional requirements such as conformity, intelligibility, adaptability and testability are to be met and supported. Since software development is a creative process, an explicit division into „good“ or „bad“ code is not easy. Nevertheless, code quality can be described using suitable software metrics.

Analyze quality characteristics?

Tools for evaluating software quality in the high-level language area already support developers and their teams in maintaining critical, non-functional aspects of their software. Programming languages that are not supported by conventional tools (IEC 61131) are used especially in machine and plant construction.

However, the software developed is subject to the same security and quality requirements as high-level language software, but cannot be checked manually without automatic analysis due to the complexity and size of the projects.

An analysis of quality metrics in the area of PLC languages enables machine and system builders to apply the advantages of code quality measurement methods to parts of their software projects that have not yet been analyzed.



We are guided by industry standards!

In cooperation with the company TIOBE, which is established in the field of software quality, we are developing a tool that can analyze software in the languages of IEC 61131 for compliance with quality metrics.

The metrics are based on the existing TIOBE Quality Indicators. These were created by following the requirements of the ISO standard on the subject of code quality (ISO 25010) and have become established in the industry.

Besides, an interface to the existing TIOBE TiCS framework is implemented, which means that the advantages of graphical visualization and database features can also be used for PLC languages.



APPROACH

Sound recommendations

The software tool enables developers to check their projects or individual files for violations of standardized quality metrics:

- Code Duplication
- Cyclomatic Complexity
- Security
- Fan Out
- Code Coverage

- Compiler Warnings
- Abstract Interpretation
- Coding Standards

In conjunction with the TIOBE TiCS framework, features for continuous integration can be used. Including database services and trend histories with a graphical user interface for easy tracking of software quality over the life of the analyzed software.



“The PLC projects of our customers are highly complex and are subject to the strictest requirements. Our tool makes it possible to reduce this complexity.”

Laurenz Noack
Software Engineer

✉ noack@itq.de

BENEFITS

Compliance with software quality metrics enables:

- Enhanced readability
 - Easier bug fixing
 - Faster training of new employees
 - Improved teamwork
- Improved testability
 - Code that was previously untestable can be tested now
 - Tests can be standardized and automated
- Better adaptability/modularity
 - Flexible code changes
 - Independence of modules
 - Long durable software

SERVICES

We offer you!

- In-house training
 - Coding Standards
 - Code Reviews
 - Automated tests and fields of application of the analysis tools
- Creation of a comprehensive analysis report of your software project
- Deployment of the analysis tool and assistance with the use
- Advice and support for TIOBE TiCS Framework Deployment
- Advice and support for code restructuring

VR AND AR IN MECHATRONICS

ENGINEERING IN VIRTUAL SPACE

COMPETITIVE ADVANTAGE VIRTUAL

Virtual (VR) and Augmented Reality (AR) applications with data glasses represent a modern way of supporting staff on site from a distance. Sales meetings or service and assembly work can take place remotely. VR or AR applications also offer decisive competitive advantages in the development of machines and systems. We show you possible applications in your company and support you throughout the entire process.

Do your teams speak a common language?

Today's development teams are interdisciplinary and development projects across locations, with several disciplines contributing partial developments.

Each discipline has its own language and tools (M-CAD, E-CAD, SW design). The use of VR/AR can support a common understanding.

In addition, the presence of a specialist on site for service and maintenance is not always possible or only possible with cost-intensive trips to the customer on site.

With the help of Virtual and Augmented Reality applications, problem situations can be solved quickly and easily.



Diverse application possibilities of Virtual and Augmented Reality

Thanks to Virtual Reality, machines and systems can be represented digitally and brought to life virtually. In this way, the respective development status is visually comprehensible for all teams involved.

With the help of VR/AR glasses, the user moves in a virtual 360-degree scene. Here, the perception can be enriched with corresponding information depending on the situation and thus support the user in operation.

The use of Virtual and Augmented Reality technologies results in a wide range of possible applications over the entire life cycle of the machine.



APPROACH

Which solution will make you successful?

In order to take full advantage of the new technologies, machine builders need clear strategies and plans.

The focus is on the provision of the necessary technology, digital models as well as data preparation and processes for visualization. We show your employees how different expansion stages of a machine or factory can

be clearly visualized right from the start, and remotely maintained in the product life cycle.

We train your sales staff so that they can make the machine with its functionalities and processes understandable to their customers. Sales benefit from being able to visualize processes.



"The VR/AR tools enable us to support the specialist staff on site remotely. Maintenance and troubleshooting can therefore be carried out live."

Felix Rhöse
Senior Consultant

✉ rhoese@itq.de

BENEFITS

Virtual and Augmented Reality offer you:

Virtual Reality in development

- Offers more options than a pure CAD tool
- Models can be used from prototypes to virtual commissioning
- Support of basic human mechanisms („turning head“, „walking“, „thinking in“)

Augmented Reality for remote service & assembly

- Little hardware/software effort required
- Saving of travel times and costs
- Faster response times
- Exact knowledge of the problem at hand

SERVICES

Our offer pays off for you!

- In-house training on VR and AR with a focus on applications in mechanical and plant engineering
- Comparison and selection of tools such as Vuforia chalk, XMReality, Scope AR, RE'FLEKT
- Development of customer-specific, tailor-made solutions
- Cross-location coordination option
- Demonstration of possible uses in sales
- Early clarification of complex processes in machines and systems
- Creation of a common understanding across all trades

INTERIM MANAGEMENT

DIGITAL TRANSFORMATION – FAST AND EFFICIENT

DIGITALIZATION REQUIRES EXPERIENCED LEADERSHIP

Many companies are facing the challenge of introducing new ways of thinking and working due to digital change. The transformation of companies is a demanding task, which requires competent management staff to master. ITQ knows from a large number of projects how companies can best position themselves organizationally and technically in order to efficiently advance the digitalization of processes, products and projects.

Do you have all the skills in-house?

The history of many German (mechanical engineering) companies has been shaped by the fact that they have become world market leaders thanks to excellent mechanical solutions and typical German quality standards.

Due to the steadily increasing influence of software on the functionality of the systems, machines and devices, companies are under increasing pressure. They are by far not as well prepared for the new agile, function-oriented way of working, which is required by digitalization.

In many cases, there is a lack of experienced (project) managers in companies to drive the digital transformation forward.



Whether project managers or teams – We support you!

Thanks to the in-depth technical expertise of our ITQ employees and their extensive project and change management know-how, we can support companies quickly and efficiently in a wide variety of project and management situations.

After a very short training period, we can support the existing staff in a targeted manner and get the projects on the right track. It is often found that there are not only organizational but also technical deficits in projects with a high proportion of software. In order to close these capacity gaps, we can not only offer management support but also complete teams that help to implement the projects.



**DIGITAL
TRANSFORMATION**

APPROACH

We will design your realignment together!

Our experienced managers and project managers not only bring ideas and tried-and-tested concepts but are also able to push ahead with a technical and organizational realignment of your company due to our extensive market knowledge. In the course of this, we work with you to design your product strategy, define road maps and calculate realistic budgets.

Together with you, we think about how you can strengthen your teams professionally either with specialists from your own ranks or through acquisitions or partnerships with other companies. Our employees stand for deep technical expertise, high social competence, assertiveness and decisiveness. We focus on project success and not on politics in our own right.



“Thanks to our many years of project experience, we have extensive know-how on how companies can best face digitalization professionally and organizationally.”

Dr.-Ing. Rainer Stetter
ITQ Managing Director

✉ stetter@itq.de

BENEFITS

Benefit from external know-how!

- Targeted support in difficult company and project situations
- Comprehensive project and change management know-how
- Independent outside view to break open stuck structures
- Advancing digital ways of thinking and working
- Not only support in (project) management but also support from complete teams possible
- Experience and above-average success in comparable projects

SERVICES

Our expertise pays off for you!

- Support the organizational and professional transformation
- Use of complete teams for fast implementation of new technologies in projects
- Introduction of agile working methods
- Technical competence in all matters of digital engineering
- Consulting and due diligence in advance of acquisitions/partnerships
- Coordination of cross-location (also international), agile teams
- Experience and above-average success in comparable projects