

Q-PLM - QUALITY ASSURANCE
FOR VET PROVIDERS USING
**PRODUCT LIFECYCLE
MANAGEMENT**



Handbook

for

Active Product Lifecycle Management for VET Providers

Final version, September 2015



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Abbreviations

Abbreviation	Description
CQAF	Common Quality Assurance Framework
CM	Configuration Management
CVET	Continuing Vocational Education and Training
EDMS	Electronic Data Management Systems
EQARF	European Quality Assurance Reference Framework for VET
EQAVET	European Quality Assurance in VET
ISO	International Organization for Standardization
IVET	International Vocational Education and Training
KSF	Key Success Factor
LLL	Lifelong Learning
PDCA	Plan-Do-Check-Act
PDM	Product Data Management
PLC	Product Lifecycle
PLM	Produce Lifecycle Management
Q-PLM	Quality Assurance for VET Providers Using Product Lifecycle Management
VET	Vocational Educational Training
WP	Work Package

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1 Introduction

There are millions of products on the economic market, these products include services. Vocational education and training is one of these services.

All products, including vocational educational and training products, have a lifecycle. Each lifecycle must be managed. In this context, the lifecycle of VET products must be managed.

Services and products on the vocational education and training (VET) market are being influenced by a vast number of factors and variables. VET products have a certain product lifecycle, as do all products on the economic market. There is a high demand for a coherent and practical instrument for the monitoring of the lifecycles of VET products, with consideration of several key success factors and indicators influencing vocational training and education programmes.

Q-PLM - Quality Assurance for VET Providers Using Product Lifecycle Management, 538379-LLP-1-2013-1-AT-LEONARDO-LMP – is a Leonardo da Vinci Multilateral Projects for Development of Innovation project. It started on the 1st of October 2013 and ends on the 30th of September 2015.

The main aim of the Q-PLM project is to, in an adapted form, transfer Product Lifecycle Management (PLM) that is primarily being used in the industrial and IT area, to the field of further education. Active PLM facilitates product control, -planning, -adaptation and product innovation, thus enabling a market orientated approach of the portfolios in further education.

This project foresees the development of an IT-based tool for an integrated product lifecycle management for VET providers which facilitates product control, planning, adaptation and innovation, thus enabling a market-orientated approach of the portfolios in further education.

There is a strong need at the VET providers' level for a coherent and practical instrument

- to monitor the lifecycle of VET products
- to monitor several key success factors and indicators influencing the performance of a VET service / offer
- to assess changes and their impact on the VET offer
- to allow early and immediate reaction to the rapidly changing VET market
- to adapt VET programs more easily to the requirements of the labour market
- to respond better to the pressure of innovation in VET

Active Product Lifecycle Management, including the use of suitable PLM software, can be recommended as a tool for monitoring and controlling the product portfolio of an educational institution. It can not only be recommended for reasons of quality assurance, but also for the facilitation of the product development process, for more transparency in strategic business areas and, last but not least, for the maintenance of the competitiveness of VET providers.

2 Background, objectives and aims of the Q-PLM project

A vast number of factors and variables are influencing services and products on the vocational education and training (VET) market. Product lifecycle management is a conceptual approach which takes a product into consideration throughout its entire lifetime. Each product on the economic market has a certain product lifecycle - as do VET products. Product lifecycle management can be an appropriate tool for the measurement of indicators of a VET product and the management of its lifetime. There is a high demand for a coherent and practical instrument for monitoring the lifecycles of VET products taking into consideration the several variables influencing VET offers at the VET provider level.

Analyses show clearly that VET providers are in need of easy-to-use, flexible and reliable quality assurance methods. The Q-PLM project analyses the background of product lifecycle management from other sectors, identifies relevant variables having an impact on the VET offer's lifecycle and, based on this, has developed an IT based instrument (software) for product lifecycle management for VET providers, as well as a handbook for product lifecycle management.

The product lifecycle management approach followed in the production industry, but also in service sectors, builds on the fact that: *“All products and services have certain life cycles. The life cycle refers to the period from the product's first launch into the market until its final withdrawal, and it is split up in phases”¹.*

PLM lies at the heart of a company's efforts to move a product to market and beyond. At its essence, PLM describes the engineering aspect of a product, from managing descriptions and properties of a product throughout its development and useful life. It is the process and practices associated with managing the entire lifecycle of a product - from its conception, through design and manufacture, to service and decommission. As a methodology, PLM integrates people, data processes and business systems, while providing a product information backbone for companies and their extended enterprises”²

¹ Cf. Ioannis Komninos: “Product Lifecycle Management”; Aristotle University Thessaloniki, 2002

² Cf. Top_10_PLM_Report_2013

2.1 PLM in VET as an opportunity

Active product lifecycle management, including the use of suitable PLM software, is or can be a tool for monitoring and controlling the product portfolio of an educational institution. It can be recommended not only for reasons of quality assurance, but also for the facilitation of the product development, for more transparency in the strategic business areas and last but not least for the maintenance of the competitiveness of VET providers. There is a high demand for a coherent and practical instrument for the monitoring of the lifecycles of VET products, with consideration of several key success factors and indicators influencing vocational training and education programs.

Product development for VET providers:

The development, innovation and introduction of new training programmes and the adaptation of existing services are the key success factors for vocational educational training institutions. The main challenges for the product development in the VET sector are the increasing competition on the VET market and the resulting pressure to innovate. Product development is an active process which is always associated with extensive research work. Market observations and surveys, competitor analysis and internal and external feedbacks, feedbacks from training staff, sales staff and from corporate networks form the basis for new educational product ideas.

2.2 Q-PLM Project outputs and results

The main objective of the Q-PLM project is to, in an adapted form, transfer the product lifecycle management that is primarily being used in the industrial and IT area to the field of further education. Active PLM facilitates product control, planning, adaptation and innovation, thus enabling a market-orientated approach of the portfolios in further education. The main aim of the Q-PLM project is the development of an IT-based tool for an integrated product lifecycle management for VET providers.

In detail, the Q-PLM project foresaw the following outputs and results:

- 1) **Analysis of existing PLM (Product Lifecycle Management) Software:** Since PLM is an approach followed for quite some years in other economic sectors – mainly the production industry and IT sector – software and IT based solutions already exist from these other sectors. In a short investigation phase, the existing PLM software was briefly screened for good practical elements that can be used for the intended PLM tool for VET providers.
- 2) **Research about key success factors influencing the product lifecycle of a VET offer / service:** the most important task in the Q-PLM project was a profound and widely based identification of relevant key success factors, which might have an influence on the lifecycle of a VET offer. It was crucially important that this research phase closely involved the members of the different target groups and the stakeholders of the VET providers. At the end of this research activity 10 main key success factors, which were discussed and agreed upon within the partnership, could be identified as the basis for the PLM tool.
- 3) **Identification of indicators for product lifecycles in VET:** apart from the identification of relevant and valid key success factors influencing the product lifecycle of a VET offer, the task was to find reliable indicators for measuring the different key success factors identified. Again the partnership and the stakeholders from the IVET and CVET sectors were substantially involved in the identification of the indicators.
- 4) **Development of a software product for active product lifecycle management for VET providers:** On the basis of the research results and the identification of the

technical and functional specifications and requirements for the Q-PLM software, the beta version of the PLM software for VET Providers was developed.

- 5) **Development of a handbook for active product lifecycle management for VET providers:** the Q-PLM handbook describes the use of the Q-PLM software. Apart from that it supports the users of the Q-PLM software by giving additional information about PLM and it increases their knowledge of key success factors and variables influencing a product lifecycle in VET.
- 6) **Pilot phase for beta version and handbook:** The involved VET providers underwent a comprehensive testing and pilot phase for the developed software and handbook. Feedback about the experiences made were be gathered and channelled into a revision phase of the software and the handbook.

2.3 PLM software for VET providers

Analysis shows clearly that VET providers are in need of easy to use, flexible and reliable quality assurance methods. The Q-PLM project analysed the background of product lifecycle management from other sectors, identified the relevant variables having an impact on the VET offer's lifecycle and, based on this, developed the beta version of an IT based instrument (software) for the product lifecycle management for VET providers, as well as a handbook for product lifecycle management.

PLM - software systems in general enable companies to facilitate the control of product life cycles and to manage the wide range of product data in an efficient way. Optimally coordinated processes across multiple locations allow a quick response to changes in market demand. Thus, the right product, at the right time, can be brought to the market at the right price.

PLM-software programmes can also be recommended for the VET sector. They should be used for the coordination of training programs in the VET market and for the control of the processes and product portfolios of the training providers, thus making it easier to monitor

and visualize business processes and allow more transparency in the portfolios of VET providers.

The Q-PLM project centrally focuses on the development of an easy and flexible tool to use quality assurance methods for VET providers in the European lifelong learning arena. VET providers, social partners, labour market authorities and experts in the VET field cooperated within this project to develop the software and a handbook for VET providers to apply product lifecycle management as the basis of quality assurance for their VET offers and services.

The project developed an IT based tool for integrated product lifecycle which is:

- a) **flexible** so it can be adapted to national, regional and organisational backgrounds and situations, e.g. organisational quality cultures and systems, legal backgrounds, etc.
- b) **comprehensive and scientifically valid** taking into account all the relevant key success factors and indicators in the background.
- c) **easy to use for VET providers**: an easy and quick input of quality data and interfaces to existing data resources are requested in the organisation. Apart from that, the presentation of results should be clear and efficient, together with clear actions and recommendations for lifecycle management for the individual VET offer / service.
- d) **indicator based**: the lifecycle of a VET offer is influenced by a number of factors and indicators. The tool reflects the most crucial ones and gives room for adaptation to national, regional and additional local and organisational variables.
- e) **weighted and balanced**: different variables have a different weight in their impact on the lifecycle of a VET offer. The tool developed allows the possibility to weight and rate the single indicators at different stages on the product lifecycle.
- f) **IT based**: in many cases VET providers already have certain quality information and data management in electronic format. For this reason, the Q-PLM IT-tool can create interfaces to existing quality data systems in the organisation and allows a quick and efficient product lifecycle management procedure on VET provider level.

2.4 Target Groups and beneficiaries of the Q-PLM project

In general, the main target groups of the Q-PLM project and its results are VET providers from the IVET and CVET sector, who will receive an easy to use and flexible IT based instrument, as well as a handbook for managing their VET offers and improving their quality on the market. Policy makers, social partners, labour market authorities and adult education providers, who create a significant impact with their decisions and policies on the offers established by VET providers, are part of the target group as well.

The main target groups reached by the project and which are all directly represented in the project partnership are the following ones:

- **VET providers:** The providers of VET offers and services are the main target group of the Q-PLM project. According to studies and research, only a very small percentage of VET providers are currently using quality assurance models and instruments on a broader scale. The needs and requirements of VET providers for actively managing the lifecycle of their training offers are the main focus of the project. For this reason the close involvement of the target group in all activities of the project is of crucial importance during the whole project. Involvement of the VET providers is foreseen throughout the core partnership of the Q-PLM project. The project consortium contains a number of VET providers from IVET and CVET which will directly implement the project activities. Moreover, VET providers in every partner country were invited to participate in the feedback panels for the PLM. The VET providers played a crucial role especially during the testing and piloting phase, such as trying out the beta version of the PLM software and the handbook draft developed. Apart from the direct involvement of representatives from the VET provider target group in the project implementation, VET providers are also the main target group for the entire dissemination and exploitation activities planned in the project. The strategic approach of dissemination and exploitation centrally focused on the needs, motivation and channels to reach VET providers with the results of the Q-PLM project.
- **Adult education providers:** In many cases the problems and challenges of adult education providers appear similar to the ones of VET providers. In terms of planning the appropriate offers for a market, the approaches are similar to the ones of VET providers. For this reason, integrated product lifecycle management is also relevant

for adult education providers. Thus adult education providers were also invited to participate in the feedback panels in the partner countries concerned, to enrich the views and feedback with their perspectives.

- **Labour market organisations:** VET providers have, by nature, a close relationship and interaction with labour market organisations. IVET and CVET are both seen as effective measures against unemployment and an appropriate VET offer can provide the right skills and competences for the jobs available on the labour market. The response to the VET market's needs is a crucial quality criterion for the planning and management of VET offers and services. The opinion and views of labour market organisations are crucial for product lifecycle management in VET and therefore they are closely involved in the project development.
- **Social partner organisations:** In many countries VET providers are closely related to social partners. Furthermore, in some European countries social partners play the most important role in VET and are running their own VET centres. In general the influence and opinions of social partners are a crucial factor in VET planning, quality assurance and in the process of product lifecycle management. For this reason it was important to closely involve representatives from the social partners in this project. The applicant organisation itself is carried by the Trade Union and the Federal Chamber of Labour and represents the employees' part of the partnership. In addition, the Slovenian project partner as the chamber of commerce represents the employer part of the social partnership.
- **VET policy makers:** Quality assurance, as well as methods and instruments used for the quality assurance in VET, do not only create an impact on VET providers but also on the VET system level. The opening of the perspectives of quality assurance methods towards approaches already successfully running in other economic sectors as in product lifecycle management is also important for the VET system as on the VET policy maker level.

2.5 Q-PLM Partnership

The prerequisites for a successful project partnership are mutual trust and intercultural understanding, which have both formed the basis of communication and cooperation in the Q-PLM partnership since the beginning of the project.

The Q-PLM partnership consists of the following 8 European institutions:

	P1	AUSTRIA	Berufsförderungsinstitut Steiermark, www.bfi-stmk.at
	P2	GERMANY	INIT Developments, Ltd, www.init-developments.eu
	P3	BELGIUM	Syntra West vzw, www.syntrawest.be
	P4	SPAIN	Fondo Formación Euskadi, www.ffeuskadi.net
	P5	FINLAND	WinNova, www.winnova.fi
	P6	IRELAND	Cork Education and Training Board, www.corketb.ie
	P7	SLOVENIA	Gospodarska zbornica Slovenije, www.gzs.si
	P8	ROMANIA	Universitatea Ștefan cel Mare din Suceava, www.usv.ro

The Q-PLM partnership represents the following different perspectives and experiences relevant and necessary for the project development:

a) **VET providers** involved in national, regional and local VET systems. These organisations provide VET offers / services as they plan VET courses for learners and try to actively monitor and manage the offers on the market. These VET providers who had experience with the evaluation of satisfaction and a good knowledge of the possible influence of factors on VET offers, contributed to the development phase of the project. Moreover the VET providers were also actively involved in the testing phase of the integrated product lifecycle management instrument developed for VET providers.

b) **VET consultants** who are active on consultancy at the VET policy level and who are deeply involved in the quality assurance discussions in VET.

c) **Higher education institutions** concerned with the product lifecycle management theory and background. They provided a theoretical background especially in the development phase of the project outcomes. Moreover they supported the pilot implementation with the necessary scientific know how about product lifecycle management, as well as the revision phase of the project outputs.

d) **Social partners – chambers of commerce** (one major issue for the quality of VET offers is their coherence with the needs of the labour markets, and especially the companies active on national and regional markets. The interests and needs of companies are best represented by the chambers of commerce, which will provide this important perspective for the quality of VET offers during the development phase of the IT based product lifecycle management instrument)

With these different aspects in the foreground, the consortium can well cover the planned main activities of project management, quality management as well as the development of the IT based product lifecycle management tool. Moreover the extensive and varied representation of VET providers permits the reflection of different needs (also related to smaller and larger VET providers acting in different national and regional markets), as well as a broad and intensive testing phase of the beta version of the product lifecycle management software for VET providers. It is important to mention that within the setup of the consortium it is possible to involve the members of the projects' target groups directly in the project process, which will positively influence the relevance and exploitation potential of the project results.

In addition to this, the project appears geographically balanced and can provide a real European perspective and dimension in its results.

2.6 European added value

The frame for the European added value created for and by the Q-PLM project was set up by the European Quality Assurance Reference Framework (EQARF) and all the initiatives around improving the quality assurance within VET on provider and system level. There is clear evidence that the majority of VET providers throughout Europe are still not focusing enough on the indicators and criteria established by EQARF for the improvement of quality.³

One problem identified, especially on the provider level, within the quality assurance in VET is that quality assurance instruments and methodologies available and known to providers are quite complex and theoretical. Most of the time they require a huge effort and resources to be operated, and especially smaller VET providers cannot provide these resources and create some kind of corporate quality culture in their own organisation. According to the available studies and information, this is a European wide problem and must be recognised and approached as such. On the other hand, different European countries and VET providers active in these countries do have different experiences with quality assurance tools and partially also provide accreditation for quality assurance models of VET providers etc. Thus it is evident, that the different European countries together with their providers have vast and different experiences with quality assurance, which can be perfectly be used as a common experience basis for the development of the instruments and outputs within this project.

The results of this project are available in all partner languages (DE, ES, EN, NL, SI, RO and FI), which will support the European wide use of the results. Moreover the flexible and customizable character of the product lifecycle management software for VET providers will allow for easy and appropriate adaptation and processing of variables, weights of variables, indicators and results, according to local, regional and national requirements. On this basis the outcomes of the project can be used in any VET provider organisation (IVET as well as CVET) in Europe and can build on common European quality assurance principles.

³ Cf. EQAVET findings 2012

3 Quality management for European VET providers

By focusing on the quality, on the improvement and evaluation of the outputs and outcomes of VET, a professional quality management for VET providers:

- increases transparency and mobility
- increases transparency, consistency, portability and recognition of qualifications and competencies received by learners across different countries or learning environments.
- enhances the mobility of learners and workers
- valorises permeability in a lifelong learning perspective
- facilitates the permeability of learning paths between VET, general education and higher education without extending learners' education and training
- contributes to the overcoming of current unemployment problems by addressing the gap between labour market needs and labour force qualifications
- allows more flexible pathways, enhancing the opportunities for lifelong learning
- makes VET more attractive
- can enrich training provisions
- increase the attractiveness of training
- better access to lifelong training
- programmes and enhances their pan-European reputation
- facilitates cooperation between VET providers and companies.

Q-PLM extends the quality-management in training services, on the different phases of the product lifecycle of VET products. This is an important plus in assuring the quality of an entire process.

3.1 The European Quality Assurance Reference Framework (EQARF)

The Common Quality Assurance Framework (CQAF), as well as the European Quality Assurance Reference Framework for VET (EQARF) are both considered as the basic policy approaches to improve the quality of VET provisions and services in the European member states. CQAF outlining a theoretical quality model building on the PDCA (Plan-Do-Check-

Act) circle for quality assurance, details the four steps which should be followed to improve the quality of services on a systematic basis. The PDCA circle for quality assurance is referred to, as well as the Deming Cycle or the Deming Wheel (after its proponent). Deming introduced statistical process control techniques for manufacturing⁴. Later on the PDCA Cycle influenced the quality theories with the problem solving approach.

The EQARF gives policy recommendations, as well as concrete indicators for policies and at the VET provider level, which should be taken into consideration. There is no doubt, that “Implementation of an internal quality management system by VET providers can be considered one of the most crucial issues to improve quality at their level. This instrument allows them to strive continuously for better quality.”⁵ However, studies performed in the European member states about methods and approaches in use show significant shortcomings with the use and implementation of quality assurance frameworks at the VET provider level: “In several frameworks, however, certain elements constituting a fully operative quality management system are not sufficiently addressed and defined. Specifying the prerequisites for effecting operation of a quality management system is a common challenge.”⁶

The ENQA-VET thematic working group comes to the conclusion that “The development and implementation of a comprehensive, coherent and systematic quality assurance system cannot be taken for granted. It has to be nurtured, supported and regularly reviewed and effective quality assurance systems in VET are dependent on the strong involvement of internal and external partners and relevant stakeholders”.⁷

Whereas VET providers are paying attention in most cases to at least some of these factors and variables when planning for new VET offers / services, the continuous monitoring and evaluation process, if at all implemented, unfortunately disregards most of the variables. The VET providers focus on the content development, according to identified needs, having in mind more the “good organisation and delivering” of training services, than the focus on quality in each phase.

⁴ http://www.washington.edu/research/rapid/resources/toolsTemplates/plan_do_check_act.pdf

⁵ CEDEFOP: “Assuring quality in vocational education and training”, 2011

⁶ CEDEFOP: “Assuring quality in vocational education and training”, 2011

⁷ Cf. European Network for Quality Assurance in VET ENQA-VET: “Supporting system-wide quality assurance in VET”, 2009

The EQARF framework formulates the measurement of indicators on a broad and especially external basis for all of the four quality criteria (planning, implementation, evaluation and revision), at the VET provider level, and the following indicative descriptors are mentioned:⁸

- The relevant stakeholders participate in the process of analysing local needs
- Relevant and inclusive partnerships are explicitly supported to implement the actions planned
- Evaluation and review includes adequate and effective mechanisms to involve internal and external stakeholders
- Early warning systems are implemented
- Results / outcomes of the evaluation process are discussed with the relevant stakeholders and appropriate action plans are put in place”

There is a strong need at the VET providers’ level for a coherent and practical instrument to monitor several variables influencing the performance of a VET service / offer, assess changes and their impact on the VET offer to allow early and immediate reaction. This instrument will contribute to a clear identification of the errors and weaknesses in the training process, and will help the VET provider to identify and ”localise” the gaps and to improve the overall product.

Assessing changes on the level of what variables have an influence on an offer has already been implemented in other economic sectors for some time; and this is the main aim of Product Lifecycle Management (PLM).

The development of a practical and easy to use IT based instrument for the integrated product lifecycle management for VET providers is the main aim of the Q-PLM project. Product lifecycle management provides the VET providers with an instrument that allows the identification of relevant influence variables which have an impact on a specific VET service / offer, the weighting of different variables in terms of impact value, the measurement of the values of variables and the forecast of their impact on the lifecycle of the VET offer on the market. This is coherent with the strategies explicated under the EQARF framework, the quality criteria and indicators stated, as well as with the common quality framework which is the foundation of the whole quality assurance processes in VET.

⁸ Cf. European Quality Assurance Reference Framework: Quality criteria and indicative descriptors”, 2009

Q-PLM will provide an easy to use IT based instrument (software) which all VET providers (no matter of what size) can use to actively manage the product lifecycle of single VET offers / services. The instrument developed within this project will ensure that VET offers have the appropriate content and learning outcomes, the appropriate duration, the appropriate didactic format, the appropriate price and are offered at the most appropriate location. Integrated product lifecycle management can be a pragmatic and efficient solution for the need of VET providers related to instruments for quality assurance of VET offers made.

3.2 The European Quality Assurance in VET network (EQAVET)



Figure 1: EQAVET: European Quality Assurance Reference Framework for Vocational Education and Training- a tool for VET providers

The EQAVET – European Quality Assurance in VET network comprising members from the European member states, the European Commission, the national reference points, social partner organisations as well as scientific advisors (www.eqavet.eu) comes to a similar conclusion about the use of the EQARF indicators on VET system and provider level. In a report about the usage rates presented in 2012 it was clearly shown, that only about 27% of VET providers in Continuous Vocational Education and Training are using the indicators and approaches of the CQAF (Common Quality Assurance Framework) in some way. In IVET

(Initial Vocational Training) there is no significant increase of VET providers really using these approaches.⁹

This also means that making use of the indicators combined with practicable, feasible and efficient methods for VET providers is still a crucial issue, which needs to be solved. Such an instrument will provide a real support to VET providers, a ready-to-use tool that will help them to plan properly quality-related steps in advance. VET providers can only plan, implement, evaluate and review their VET offers better for the future with an easy to use and at the same time efficient and effective instrument.

Integrated product lifecycle management gives an efficient solution to this problem – the approach is well tested and used in other economic sectors (not only in production but also in the service sector), it can reflect the complexity of social processes such as learning, the labour market, economy, business but also individual learner satisfaction, motivation, biography and other pedagogical issues. For this reason and based on the situation found at the VET provider level in the European member states concerning the use of quality assurance approaches and instruments, the development of an innovative instrument for the quality assurance of VET offers on the basis of Integrated product lifecycle management appears to be an appropriate and promising solution, creating the main objective of the Q-PLM project.

3.3 Internationally recognised quality systems

It seems that the quality management discussion on VET still remains very much on the policy level and VET providers still do not follow the policy recommendations by implementing coherent and integrated quality management systems. Whereas large VET providers run an integrated internationally recognised quality management system (e.g. based on ISO 9001 etc.) most of the time, smaller VET providers are lacking practical instruments allowing continuous monitoring and the improvement of service quality. Smaller VET providers don't invest the time and money to systematically evaluate plans and offers, to analyse influence variables and make deductions from the improvement and change mechanisms.

⁹Cf. <http://www.eqavet.eu/gns/what-we-do/implementing-the-framework/progress-report.aspx>

The main problem identified with the quality assurance in VET on a provider level is that it is actually a wide number of factors and variables that are influencing the quality of a VET offer / service, and the measurement of this vast number of indicators creates a methodological and resource problem. Moreover, especially smaller VET providers do not invest the time and money to systematically evaluate plans and offers made, analyse influence variables and make deductions from the improvement and change mechanisms. It requires a profound knowledge of empirical processes to set up a valid instrument to measure variables and analyse their impact on the individual VET offers. “Keeping a balance between the variables influencing training provision is a precondition if positive effects in one area are not to be at the cost of negative or counter effects in another area”.¹⁰

3.4 Nationally approved quality systems

On the national level, larger VET organizations in general use quality management models, quality manuals, operating handbooks, standardised processes, internal and external audits, feedback questionnaires, etc. Quality management also includes the recruiting and development of competitive, qualitative staff, qualitative knowledge management systems, annual course review meetings, learner’s feedback sessions and surveys and quality control policies, internal and external evaluation

During WP 5 – the research and analysis phase – the partnership of the Q-PLM project was investigated to see if the national organisation uses use a certified (EFQM, ISO, ...) or other quality management system and if this system relates to the national processes and/or products.

The most important answers to these questions, gathered between January and March 2014, were the following:

- Smaller organizations in the partnership do not use a certified system.
- Larger organizations use internationally recognized systems (ISO 9001, ISO 14001, OHSAS 18001, EFQM, QFor) or nationally approved systems e.g. Austria (ÖCERT, TÜV).

¹⁰ Cf. CEDEFOP: “Accreditation and quality assurance in vocational education and training”, 2009

- In Ireland the Quality and Qualifications Ireland (QQI) is responsible for the external quality assurance of further and higher education and training.
- All partner organisations use quality manuals, operating handbooks throughout system/service as well as an integrated management systems (IMS) and customer (and employee) satisfactions
- The national public organisations coordinating the VET activities, speak more about the quality of the general framework, and only refer in general to the quality of the VET process¹¹.
- When the VET partner organizations evaluate training products, the following Key Performance Indicators used are mostly:
 - Market potential
 - Enrolment rate
 - Participant rate
 - Retention rate
 - Customer satisfaction and feedback on:
 - Cost analysis
 - Turnover
 - Staff availability
 - Marketing
 - Quality checks after/during training
 - Complaint rate
 - Employment and further studies of students after qualification
 - Evaluation mechanisms
 - Appropriate certification

¹¹ http://cnfpa.ro/Files/Asigurarea%20calitatii%20FPA/rap_romana.pdf

3.5 Learners satisfaction

Above all, quality systems in VET should address the learners' needs. That is the reason why evaluation is mainly focused on assessing learner satisfaction with the training offer, maybe VET providers should involve some external stakeholders to analyse the impact on the labour market etc. Nevertheless a coherent approach and instrument for monitoring VET service/offer performances is not evident and in place with most of the VET providers.

A learner satisfaction survey is an opportunity for existing participants in VET to rate their learning or training. This helps VET institutes make informed choices about where to study or train. The learner satisfaction performance indicator gives a score at training organisation-level on how learners rated a particular organisation and is based on answers to the learner satisfaction survey.

A learner satisfaction questionnaire is a set of questions to be filled out by the learners of an institute or educational centre to find out the responses of the learners and whether or not they are satisfied with their experience of learning. These questionnaires consist of both subjective and objective questions and in general the questions are precise and to the point. Given below is a sample of a learner satisfaction questionnaire which can be used for reference purposes.

Quality management systems are integrated into all operational activities, into every step of the product lifecycle, i.e. during market research, product development, product delivery on the market, evaluation and the process of continuous monitoring of price and user satisfaction.

Learner satisfaction and feedback depends on:

- Organisation of the training programme
- Infrastructure and technical equipment
- Learning contents and learning outcomes
- Teaching and training materials
- Satisfaction with the trainers
- Training methods
- Pedagogical competences of trainers
- Successful completion of training
- Investment in participants' motivation

4 Products, product lifecycles and product lifecycle management

4.1 What is a product?

Usually, when talking about products we mean tangible products, i.e. goods. The term “goods” refers to physical, tangible products that can be owned, traded, and distributed to different places at different times without changing their identity.¹²

However, a product can also be something very intangible such as a piece of software, a piece of knowledge or a training lesson.

4.2 What is the product lifecycle?

The product life cycle is a business technique that attempts to list the stages in the lifespan of commercial/consumer products. The 'Product Life Cycle' (PLC) is used for determining the lifespan of these products; such as the normal phases through which a product goes over its lifespan.¹³

4.3 What is Product Lifecycle Management?

Product lifecycle management (PLM) is a systematic, controlled concept for managing and developing products and product related information. PLM is a tool for the management and control of the product process, in particular product development, production and product marketing. Furthermore, it facilitates the control of product related information throughout the product life cycle, from the initial idea to the scrap yard. PLM also refers to an information system developed to manage product lifecycles and product related data.¹⁴

PLM concepts were first introduced where safety and control were of utmost importance, notably the aerospace, medical device, military and nuclear industries. From these industries

¹² Cf. Saaksvuori, Immonen (2008:1)

¹³ Cf. http://en.wikipedia.org/wiki/Product_lifecycle, 09.10.2014

¹⁴ Cf. Saaksvuori, Immonen (2008:3)

the discipline of configuration management (CM) originated, which evolved into electronic data management systems (EDMS), which then further evolved to product data management (PDM).

Over the last ten years, manufacturers of instrumentation, industrial machinery, consumer electronics, packaged goods and other complex engineered products have discovered the benefits of PLM solutions and are adopting efficient PLM software in increasing numbers.¹⁵

Active product lifecycle management, including the use of suitable PLM software, is a tool to monitor and control the product portfolio of a vocational educational institution. It can be recommended not only for reasons of quality assurance, but also for the facilitating of the product development, for more transparency in the strategic business areas and, last but not least, for the maintenance of the competitiveness of VET providers.

4.4 Who uses PLM?

Product lifecycle management can be considered the cornerstone of a company and has become a strong presence in industrial production and manufacturing industry, in particular in the following fields:¹⁶

- Aerospace
- Defence
- Automotive
- Consumer Goods
- Electronics
- Energy
- Engineering
- Financial
- Food & Beverages
- Government
- Healthcare
- High Tech Electronics
- Industrial
- Medical Devices
- Tool and machine tool industry
- Pharmaceutical
- Textiles
- Wood

¹⁵ Cf. <http://www.product-lifecycle-management.com/>, 09.10.2014

¹⁶ Cf. <http://www.product-lifecycle-management.info/what-is-plm/plm-users.html>, 09.10.2014

Up to now, the concept of PLM is unknown in the field of initial or further vocational education, or if known, not used for the management and control of the portfolio of the training programmes even if there is without doubt a strong need at the VET provider level for a coherent and practical instrument to monitor the several variables influencing the performance of a VET service / offer, to assess changes and their impact on the VET offer and to allow an early and immediate reaction to the demands of the rapidly changing VET markets.

4.5 Benefits of PLM

PLM describes the engineering aspect of a product, from managing descriptions and properties of a product throughout its development and useful life; it refers to the commercial management of life of a product in the business market with respect to costs and sales measures.

Benefits of product lifecycle management are the following ones:

- A framework for product optimization
- Ability to quickly identify potential sales opportunities and revenue contributions
- Improved forecasting to reduce costs
- Improved product quality and reliability
- More accurate and timely possibility to innovate
- Reduced development costs
- Reduced time to market
- Savings through the complete integration of workflows and processes
- Savings through the re-use of already existing data

Active product lifecycle management, including the use of a suitable PLM software, is a tool to monitor and control the product portfolio of an educational institution.

It can be recommended to:

- adapt VET programmes more easily to the requirements of the labour market
- allow early and immediate reaction to the rapidly changing VET market
- assess changes and their impact on the VET offer
- control the product portfolios of VET providers more efficiently
- facilitate the product development for VET providers
- improve quality assurance for VET providers
- maintain the competitiveness of VET providers
- monitor several key success factors and indicators influencing the performance of a VET service / offer
- monitor the lifecycle of VET products
- respond better to the pressure of innovation in VET

4.6 PLM software systems

PLM software systems enable companies to facilitate the control of product life cycles and to manage the wide range of product data in an efficient way, to coordinate all actors and logistical chains involved, and reconcile the requirements of the product range with the budget. Optimally coordinated processes across multiple locations allow for a quick response to changes in demand in the market. Thus, the right product, at the right time, can be brought to market at the right price.

PLM software allows companies to manage the entire lifecycle of a product efficiently and cost-effectively, from the idea, design and manufacture, to service and disposal.

PLM is unique from other enterprise software solutions because it derives top-line revenue from repeatable processes. By providing the application depth and breadth needed to digitally author, validate and manage the detailed product and process data, PLM supports continuous innovation.

PLM empowers a business to make unified, information-driven decisions at every stage in the product lifecycle.

PLM is a comprehensive concept with the aim to control the products effectively and efficiently throughout their entire life cycle. PLM is a concept for the integration of all the information generated during the life cycle of a product.

PLM solutions establish a cohesive platform to:

- optimize relationships along the lifecycle and across organizations.
- maximize the lifetime value of your business' product portfolio.
- set up a single system of record to support diverse data needs.

PLM software can be used for the coordination of training programs in the VET market and for the control of the processes and product portfolios of the training providers. The business processes and the product portfolio can be visualized in a better way and monitored more easily.

The software industry offers PLM products so that companies are able to integrate the diverse information requirements. The largest providers are the following:

- Dassault Systèmes
- Parametric Technology Corporation SAP
- Siemens PLM Software

Some examples for PLM software solutions are:

- Contact Software (Product: CIM Database)
- keytech Software GmbH (Product: keytech & PLM DMS)
- Oracle (Product: Oracle Agile PLM)
- Procad (Product: Pro.File)

5 The product development process for VET products and the lifecycle of VET products

5.1 The lifecycle of VET products

On the economic markets we have millions of products. Services are also products. Vocational education and training are services. All products have a life cycle. So do VET products. As VET products have a life cycle, the concept of the product life cycle plays an important role in the portfolio of a VET institution. The product life cycle for educational products depends on many key success factors and indicators, e.g. on the product, on sales, on policy instruments or on national and regional characteristics.

The development, maintenance and continuous adaptation of a training program are essential and are used to adapt the seminars to the market's and participants' needs, to develop the contents and to improve the efficiency and attractiveness of a VET institution.

5.2 The phases of the product development process for VET providers

During a trilateral work group meeting in Graz /Austria in February 2014 the following 4 main phases of the (VET) product lifecycle were defined as follows:

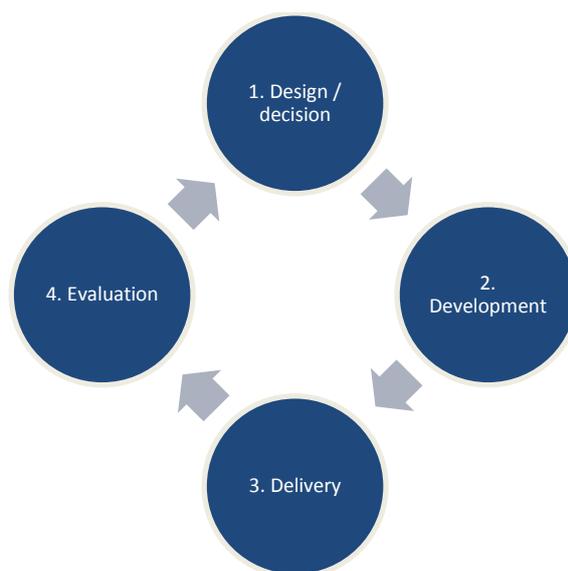


Figure 2: 4 phases in the product lifecycle of a VET product

5.2.1 Design / decision phase: conceive, analyse, specify, innovate

A VET service or product always starts with an idea for a specific training. The training developer can grasp the idea from his own experience, research (e.g. trend studies), gathered knowledge of market needs, a good insight into the competition, etc. In addition, the contribution from colleagues and especially customers are also important for the conception of ideas.

Once an idea is born, it has to be analysed. One needs to verify whether the training idea matches the organisational strategies and strategic objectives. Does it contribute to the set objectives for this sector or for the institution in general? Furthermore, in order to weigh the idea, one needs to know whether the idea fits within the analysis of the market, of the competition, of the customer. In other words, even when not yet performed, the idea developer needs to examine or analyse the needs of the market, the behaviour of the competition, the actual needs of the customer.

A very important sub phase is the feasibility study. Questions that need to be examined are e.g. who exactly is the target group? Do they need foreknowledge? Who could be our trainers? What are the resources needed, and are they available? Where do we position this offer in view of the competition, our own offers? What is the best price setting?

Risk analysis, as one of the elements within the feasibility study, or as a stand-alone element, cannot be forgotten at this stage. Environment, social responsibility and correct use of resources are aspects that also need to be taken into consideration.

Last but not least, in the design phase one needs to reflect upon the aspect of innovation. The training needs to be innovative or at least complementary to existing offers and above all, be a solution to an existing customer need.

When all the above has been performed and validated, the final decision or go ahead for the further development of the training product can be given.

5.2.2 Development phase: describe, define, develop, check, validate

When the training product in concept or design phase has received the go ahead, the actual development can start. This phase brings forth the actual product that then can be serviced or delivered to the customer.

To start with, the product will have to be described, or specified more concretely. This is the step where the training contents and approach are defined more precisely, as well as training targets and the specific segmentation of target groups that will be addressed.

A next step is to define the number of preconditions and resources: the teachers/trainers who will be involved, the learning methods that are to be used, foreknowledge and prerequisite level of students, number of lessons, specific resources and infrastructure needed, etc. Also the methods and responsible actors of examination will need to be defined.

Next, the development of the curriculum is on the agenda, explaining in detail the learning goals and methods to achieve them. The training materials that fit the curriculum need to be provided. This can be a responsibility of only the training provider, the trainer(s) or both. Then, e.g. in a so-called product sheet, all details of the training are to be entered. What is the training about? Why would one follow it? What are the results that can be expected? What are the practicalities like venue, time table, price, etc.?

Before validation, the product needs to undergo a final test. Has it been developed according to the set targets and strategies? Does it fulfil safety regulations? Are the responsible co-actors within the organisations and their responsibilities clear?

Finally, the development phase can be closed with the validation, i.e. the decision that the product is okay for market, and that prospection and marketing can begin.

5.2.3 Delivery phase: plan, produce, sell, deliver

In a very practical phase, the training product developed needs to be introduced to the market. This means that customers have to be linked to the training, as well as the time tables, teachers, training material, other resources and infrastructure needed. It goes without saying that this delivery phase needs tight planning.

Apart from providing the right framework to organise the training in, the training contents, syllabus, supporting annexes need to be produced.

The selling process is crucial to the success of the training. This includes prospection and promotion, linked to a decent marketing strategy. This strategy and its actions are based on the analysis of the target group and training needs conducted in the first phase or even earlier.

The delivery itself is the last step in this phase, and involves the actual performance of the training by the trainer to the customer.

5.2.4 Evaluation phase: define, measure, intervene, follow up - repeat, recycle or withdraw

Regarding the evaluation phase, it is important to know that this phase never ends. It starts together with the delivery of the course, and is inherent to the whole life cycle of the training product, until the eventual withdrawal of it, or the redesign and redelivery in another form, where the cycle starts all over again.

Specific indicators influencing the success of the training's life cycle are relevant and crucial and need to be taken into account in the beginning, then during the delivery and again towards the end of the course. Evaluation and the continued search for improvement are a never ending process.

Subsequently, we can subdivide the evaluation phase into the following elements:

To start with, we need to define the criteria for evaluation. What are the determinators for success and how can we measure them? Furthermore, these criteria need to be assessed or measured regularly in different target groups (customer, teacher, staff, society, etc.). Whenever and wherever needed, interventions need to be undertaken in order to guarantee the successful life cycle of the product. To conclude this part, regular follow-up actions should keep a watch on the continued life cycle.

Stemming from evaluative actions, a number of decisions regarding the life cycle are possible yet crucial. Upon gathering feedback from the suppliers and users of the training, and with consideration of all indicators linked to every phase of the VET product or service, the product provider will have to decide on repeating, recycling or withdrawing the product at regular intervals. This can logically include the plain repetition of a successful product in growth or maturity stage (cf. infra), the adaptation of a reasonably successful product in order to make it a 100% successful again, or withdraw it from market before the costs incurred exceed the returns.

6 Key success factors and indicators for active PLM for VET providers

The influences on educational products are numerous. It is not only the requirement of the labour market to observe operating conditions or the conditions of the social partners. Above all, the needs and needs of learners, regulatory environment, respected, suitably adapted learning content and the learning curve to be adapted to the learning outputs should be addressed. Furthermore, educational products are of course influenced by the teachers and their methodology and didactics.

Which are the key success factors and indicators for the different stages of the lifecycle of a VET product?

There are diverse factors that need to be taken into account for achieving success with the design and development of educational products, among them: the needs of the students / learners; the demands of the market; the learning contents. At the same time, these educational products are influenced by the teachers and their methodology and didactics.

The key success factors' influence on the different stages of the product life cycle (design, development, delivery and evaluation), make it necessary to identify the factors and the stages where they have influence to guarantee a successfully product life cycle management for vocational and educational training providers.

As explained in the previous chapter (5 - Product development process for VET products and the lifecycle of VET products), one of the first steps was the identification of the stages in the development of a product for the VET providers, in order to cover the complete product life cycle. In this sense, the allocation of the different factors/indicators in the stages makes it easier to monitor the VET product/service and to identify which part of the “product chain” is being analysed.

6.1 Key success factors for PLM in VET

During a trilateral work group meeting in Graz /Austria in February 2014 these key success factors were defined:

Key Success Factor	Definition
<i>Quality of Vocational Education and Training</i>	Improvement and evaluation of the outputs and outcomes of VET providers. How far a set of outputs and outcomes of VET providers fulfil the established criteria.
<i>Customer Satisfaction</i>	Measure how VET products and services fulfil customer expectation. Number of customers or percentage of total customers, whose reported experience with a VET provider, its products, or its services exceeds specified satisfaction goals.
<i>Quality of Staff</i>	How far the qualifications, training, knowledge, skills, competences and experience of the Human Resources of the VET providers (trainers, teachers, technicians, mentors,..) fulfil the requirements necessary to guarantee the success of their work (the quality of the VET activities).
<i>Responding to Market Demands</i>	Adapt the outputs and outcomes of VET providers to the needs and demands of the market and/or potential customers over a specific period in a specific market.
<i>Cost Control</i>	Process or activity on controlling costs associated with VET processes and activities.
<i>Suitability of Infrastructure and Materials</i>	Convenience of the infrastructures (classrooms, equipment,...) and materials (books, documents,...) to the activities developed by the VET provider.
<i>Stakeholder Engagement</i>	Process by which a VET provider involves people who may be affected by the decisions it makes, or can influence the implementation of its decisions. They may support or oppose the decisions, be influential for the VET provider or within the community in which it operates, hold relevant official positions or be affected in the long term.
<i>Strategic Provider Benefits</i>	Advantages (image, benchmarking,...) of the VET providers related to the development and implementation of their activities.
<i>Evaluation Mechanism</i>	Involve systems, procedures and tools used to get feedbacks (degree of satisfaction) from the VET activities (trainings, seminars,...).These evaluation mechanisms can get information from all the people involved in the process (trainers, teachers, learners, clients,..)
<i>Appropriate Certification</i>	How far the students have reached the competences and skills necessities to get the qualification, according to the defined standards.

6.2 50 indicators for PLM in VET

There are many variables inside each key success factor which have an influence on the quality of a VET offer / service, for example:

- labour market needs
- learner needs and satisfaction
- social partner needs
- legal situation and background
- the right duration of a seminar
- the right appropriate learning contents, skills and competences
- the appropriate and available learning effort for gaining skills and competences
- the right didactic format related to the learning needs of learners
- the certification behind
- the right and appropriate legal background
-

It is important to identify all these variables and indicators that influence a VET product/service, and to which phase of the product development they are linked, if we want to monitor and control the product portfolio of an educational institution. Thus, all the strong points as well as the areas to be improved in the different stages (design, development, delivery and evaluation) can be identified.

To this effect, from the beginning of the project development and in accordance with the Application Form of the Q-PLM project, existing indicators from the EQARF framework were looked into. These various indicators and variables were proposed and discussed during the first meeting in Schwerin in November 2013.¹⁷ Based on their experience in the field of quality management in the VET sector, the partners evaluated and assessed the indicators provided from the EQARF framework. Moreover, in separate workshops, they started to adjust and add the indicators that were considered to be relevant to their organisations and also with the collaboration with other VET provider organisations from their regions. The result of these workshops, i.e. the list of adjusted and added indicators was put in an overall document, see Annex 10.1 KSF and indicators for product lifecycle management in VET.

¹⁷ Cf. *Explanatory Brochure on the EQARF Indicators*

All indicators provided so far (January 2014) by the partners and their external contacts, were gathered in one compilation list. Together with the findings of the partners on quality management and the valorisation of indicators (see above), the next version of the indicators list was investigated in further detail during an intensive and trilateral work group meeting in Graz, in February 2014.

INDICATOR	DESCRIPTION
<i>Ability to adapt/adequate with a little effort to target groups, to market needs,...</i>	Capacity of the VET provider to adapt the VET offer to each concrete situation: needs of the target group, demands of the market, companies' needs,...
<i>Absenteeism figures</i>	Percentage (or number) of non-attendance days, hours,... to classes.
<i>Affordable price for participants</i>	Reasonable amount of money that each participant has to pay for attending the course.
<i>Anticipation of regional / national / EU / etc. policy and developments</i>	Degree of adequacy of the course to the regional/national/EU/etc. policies.
<i>Appropriate duration</i>	Number of hours is defined properly according to the contents, characteristics of the target group, competitiveness to other VET providers,...
<i>Appropriate learning content</i>	The learning contents are well defined in relation with the student's needs, market needs, employers' needs, balance between theoretical and practical training, innovative and informative value for students....
<i>Attractiveness and relevance of teaching techniques employed</i>	The techniques defined and used during the development of the course are adequate to achieve the goal, to motivate the students, to encourage the participation of the students,...
<i>Certification</i>	As a results of the training course, the student gets an official document, issued by an awarding body, which records achievements of an individual following assessment against a predefined standard.
<i>Constantly updating programmes (effort to keep updated programmes)</i>	The VET provider allocates the necessary resources (staff, time and material) to guarantee that the VET offer fulfils the requirements and needs of the market, companies, stakeholders, participants,...
<i>Continued course pathway / Progression into further levels</i>	There are possibilities to progress in further training after completing the course.
<i>Cost analysis</i>	The cost of a VET product is quantified in order to evaluate the profitability of it (if the incomes cover the costs), to compare it with other products, or to identify the non-profitable aspects.

INDICATOR	DESCRIPTION
<i>Enough and qualified staff available (trainers, call centre, organisational staff, managers,...)</i>	The teacher/trainers and all the staff involved in the design, development, delivery and evaluation have the necessary knowledge, skills and competences to do the tasks that guarantee the success of the VET product.
<i>Enrolment rate (expected and actual enrolment rate), participants rate</i>	The number of students that are registered in the course are sufficient to start the training course.
<i>Entrance requirement for students/participants</i>	Criteria that the participants have to fulfil to have access to the course.
<i>Evaluation of seminars, feedback, satisfaction within the training programme</i>	Level of satisfaction of the VET offer obtained from the people involved (participants, trainers, staff,...) and through the adequate methods of evaluation.
<i>External interest by media, partners, stakeholders, media attention (articles in media during the course, etc.)</i>	External agents, partners (outside the VET provider) show interests in the VET product. Or the course attracts the media's attention.
<i>Feedback by organisational staff</i>	Positive information obtained from the staff of the organisation related to the design, development and evaluation of the VET product.
<i>Feedback by employers</i>	Positive information obtained from the employers of the organisation related to the design, development and evaluation of the VET product.
<i>Feedback by trainees</i>	Positive information obtained from the trainees of the organisation related to the design, development and evaluation of the VET product.
<i>Feedback by trainers</i>	Positive information obtained from the trainers of the organisation related to the design, development and evaluation of the VET product.
<i>Flexibility in offering VET product (flexibility in time, place, in delivery...)</i>	It is possible to match the VET product characteristics (time, place,...) according to the market demands, participants' needs,...
<i>Importance of a course to the image of the VET provider (benchmarking)</i>	The VET product is a key area in the offer of the VET provider. It has a positive influence on the image of the VET provider.
<i>Inclusion of transversal competence in the training (soft and social skills, team work, presentation techniques, time management...)</i>	The VET product also focusses on the development of soft and social skills and competences as communication, time management, team work,... that are not included in the "formal" curriculum.

INDICATOR	DESCRIPTION
<i>Infrastructure</i>	External resources (e.g. computers, classrooms,...) are considered and available for the development of the VET product. If not, are we going to invest on it?
<i>Innovation</i>	New aspects (methodology, creativity, tools,...) are considered during the different stages of the product development: design, development, delivery and evaluation.
<i>Interest of other VET providers</i>	Other organisations active in vocational and educational training show interest in running some of our VET product on our behalf or through a licensing arrangement.
<i>Investment in motivation of participants</i>	Some resources of the organisation (material, staff,...) are allocated to increase the interest of participants for a specific VET product.
<i>Legal obligations</i>	All the aspects related to legal issues are considered and updated during the design, development and delivery stages of the product development process.
<i>Level of knowledge kept after finished VET</i>	The knowledge and skills are kept after finishing the VET course and applied in a real context. This information is obtained through feedback or information from customers, clients,...
<i>Market potential</i>	The VET product is linked with the market. It has been developed considering the needs and demands of the market.
<i>Market share</i>	Percentage of the market that represents the VET product. This percentage is calculated considering the amount of a specific VET product out of the total VET products.
<i>Methodological pedagogical concept</i> and	The methodology and pedagogical strategy used during the development, delivery and evaluation stages are adequate to the characteristics and needs of the learners.
<i>Participation rates</i>	The number of actual participants is, at least, the number of participants defined to consider the course profitable (from different points of view: economic, image for the VET provider,...).
<i>Pedagogical competence of trainers</i>	Trainers have the knowledge, skills and competences necessities for teaching a specific VET subjects. This information is obtained through different ways: students' feedback; clients' feedback; ...
<i>Percentage of training contents taught</i>	The percentage of the training contents have been taught according to the program and schedule defined during the design stage.
<i>Practical experience of teachers / trainers</i>	Teachers and trainers have enough practical experience for the development of the training.
<i>Prevalence of vulnerable groups in the VET system</i>	Vulnerable groups (such as disadvantaged groups, migrants, single parents etc.) are considered a priority in those courses that are designed with this premise.
<i>Recognition of European standards (ECVET, ECTS, EQF,...)</i>	The criteria and aspects related to European Standards as ECVET, ECTS, EQF,... are taken into account in the different stages of the

INDICATOR	DESCRIPTION
<i>EQF, ...)</i>	development of the VET product (design, development, delivery and evaluation)
<i>Relation between labour market and VET offer</i>	The requirements and needs of the labour market are taken into account during the design of the VET product.
<i>Return on investment for employers</i>	Mechanism and tools are used to identify the degree in which the training course has influenced in the real work place, company,...
<i>Sponsorship</i>	Funding or sponsorships are necessary to develop the VET product. There are available sponsorships or funding.
<i>Stakeholder opinions (social partners, professional organisations, public bodies, funders...)</i>	Feedback related to the VET product obtained from external agents (social partners, professional organisations, public bodies, funders...). This feedback is obtained in different ways.
<i>Success of the course</i>	The course developed has achieved the objectives established at the design stage. Percentage of objectives achieved out of the total. degree in which the objectives have been achieved.
<i>Successful completion of training</i>	Number of students/learners that have successfully finished the training course and have reached the objectives/competences.
<i>Sustainability of the VET offer</i>	The VET product has an important influence in the trainees. An important number of trainees have got a job as a result of their training or they have progressed to a higher level of training or they have used the acquired knowledge and skills in their workplace.
<i>The existence of programmes to allow access to VET courses</i>	There are local/ regional/ national/ European/ governmental programmes available to support the VET course.
<i>The level of investment in the competences of administrative and general staff members</i>	The knowledge, skills and competences of the general staff members are updated according to the new requirements and needs. Different resources are allocated to it.
<i>The level of investment in the training of trainers</i>	The knowledge, skills and competences of the trainers are updated according to the new requirements and needs of the VET offer. Different resources are allocated to it.
<i>Focus on the levels of unemployment in different social groups</i>	The course fulfils the specific needs to train unemployed people from different social groups. From the design stage the course considers different aspects related to the characteristics and needs of unemployed people.
<i>The use of acquired skills in the workplace</i>	The knowledge and skills developed in the training are used in the workplace or in a real work context.

As was explained before, the indicators were allocated in the different stages of the product development process for VET products. The following table reflects this distribution:

INDICATOR	STAGES			
	DESIGN	DEVELOPMENT	DELIVERY	EVALUATION
<i>Ability to adapt with little effort to target groups, to market needs</i>	X		X	
<i>Absenteeism figures (= measurement of quality, of course, of choice, of motivation)</i>			X	X
<i>Affordable price for participants</i>	X		X	X
<i>Anticipation of regional / national / EU / etc. Policy and developments</i>	X		X	
<i>Appropriate duration</i>	X	X	X	
<i>Appropriate learning content</i>		X		X
<i>Attractiveness and relevance of teaching technique employed</i>	X	X		X
<i>Certification</i>	X		X	X
<i>Constantly updating programmes (effort to keep updated programmes)</i>	X		X	
<i>Continued course pathway / Progression into further levels</i>	X			
<i>Cost analysis</i>	X		X	X
<i>Enough and qualified staff available (trainers, call centre, organisational staff, marketing manager,...)</i>	X		X	

INDICATOR	STAGES			
	DESIGN	DEVELOPMENT	DELIVERY	EVALUATION
<i>Enrolment rate (expected and actual enrolment rate), participants rate</i>	X		X	X
<i>Entrance requirement for students / participants</i>	X	X	X	
<i>Evaluation of seminars, feedback, satisfaction within the training programme</i>				X
<i>External interest by media, partners, stakeholders, Articles in media during the course (media attention)</i>	X		X	X
<i>Feedback by organisation staff</i>				X
<i>Feedback by employers</i>				X
<i>Feedback by the employees</i>				X
<i>Feedback by trainees</i>				X
<i>Feedback by trainers</i>				X
<i>Flexibility in offering VET offer (flexibility in time, place, in delivery...)</i>	X		X	
<i>Importance of a course to the VET provider (image)</i>	X			X
<i>Inclusion of transversal competence in the training (team work, public presentations)</i>	X	X		
<i>Infrastructure</i>	X			
<i>Innovation</i>	X		X	X
<i>Interest of other VET providers</i>	X		X	X

INDICATOR	STAGES			
	DESIGN	DEVELOPMENT	DELIVERY	EVALUATION
<i>Investment in motivation of participants</i>	X			
<i>Legal obligations</i>	X	X	X	
<i>Level of knowledge kept after finished VET</i>				X
<i>Market potential</i>	X		X	
<i>Market share</i>			X	X
<i>Participation rates</i>			X	X
<i>Pedagogical competence of trainers</i>	X	X		
<i>Percentage of training contents taught</i>			X	X
<i>Practical experience of teachers / trainers</i>	X	X		
<i>Prevalence of vulnerable groups in the VET system</i>	X			
<i>Recognition of European Standards (ECVET, ECTS, EQF...)</i>	X	X		
<i>Relation between Labour Market and VET offer</i>	X		X	
<i>Return on investment for employers</i>	X			X
<i>Sponsorship</i>	X		X	
<i>Stakeholder opinions (social partners, professional organisations, public bodies, funders...)</i>	X			

INDICATOR	STAGES			
	DESIGN	DEVELOPMENT	DELIVERY	EVALUATION
<i>Success rate of the course</i>				X
<i>Successful completion of training</i>				X
<i>Sustainability of the VET Offer</i>				X
<i>The existence of mechanisms to relate developments in labour market to VET systems</i>	X		X	
<i>The level of investment in the competences of administrative and general staff members</i>	X	X		
<i>The level of investment in the training of trainers</i>	X	X		
<i>The levels of unemployment in different social groups</i>	X			
<i>The use of acquired skills in the workplace</i>				X

The agreement on what the appropriate variables and indicators were to cover all the VET product lifecycles and, thus provide an adequate product lifecycle management, was a key aspect. Different validations with VET providers from different nations and countries could guarantee it.

7 Q-PLM software

7.1 Technical and functional specifications

Prior to the compilation of the product lifecycle management software significant steps for the development have been discussed among the partnership. Considerable discussion and analysis has taken place to identify the main indicators involved in the product lifecycle of vocational educational products, as well as the identification of the key success factors and the relationship between key success factors and indicators. The various phases of the product lifecycle management have been examined, as well as which indicators influence each phase.

Research was also carried out into existing product lifecycle management software which, while providing a good insight into the uses of the software in the industrial sector, also served to highlight the fact that the available software would not be suitable for use in the vocational education sector. The complexity of much of the existing software and the high levels of integration into the manufacturing process serve to make it of little value for our proposed target group.

At a certain point it was necessary to turn our attention to the technical specifications that may be required from the software. To achieve this, each partner was asked to fill in a questionnaire on technical and functional specifications. This work was to be carried out in consultation with the stakeholders in each country.

From a user perspective we would see the software running as follows:

- The user would be asked if he wants to give a customised weighting to the indicators, used previously, save the weighting or use the default weighting values.
- Once the weighting of indicators is set, it should be possible to see the relative key success factor weightings, which will have been calculated based on the indicator weighting.
- The user will be asked if they want to run the PLM process for the whole lifecycle of the product or for a particular period.
- Results will be displayed as appropriate, with the option for the user to choose a report and / or graphical presentation of results.
- An option to print the results will be provided.

- Ideally printouts should allow for customisation in relation to margins etc. so that they may be printed onto organisational headed paper.

Following the completion of the questionnaire by all partners, we were able to draw a number of important conclusions regarding the technical and functional specifications of the PLM software. All the stakeholders reported that they were using PC systems, although some also had Apple machines available. The oldest software package in use was windows XP but a majority of partners are using Windows 7. Based on this, the proposed software would need to run on PC based systems operating on windows XP or better. It would also seem that most organizations have some technical support in place so the issue of installing the software and ensuring that it is running correctly on partner institute machines would not appear to be an issue.

Most partner institutions receive management information from remote locations, some via private networks, but primarily through the internet. Generally VET providers seem to use management information systems but there is no consensus as to which system should be used. Existing solutions to Management Information Systems include, Nagios, Microsoft System Centre, SharePoint, OTRS Ticketing, EDU-ERP, Oracle EBS, Oracle People Soft, Oracle BI, Revisal, Saga, Winmentor, CRM, web CMS, as well as a number of custom written systems. The integration of our PLM software with all of these systems would clearly be impractical and expensive. However many of these systems are SQL based and the PLM software should ideally be SQL based, with the possibility open for future integration with an institutions wider system.

Most partners are not engaging with Information Technology based Quality Management systems at present, although all follow best practice in quality management and have a strong commitment to achieving consistent quality in their vocational products. In Finland the IMS Integrated Management System Software is in use. This is a browser-based platform for a quality management, operating or management system. The IMS software includes five essential functions: a tool for drawing processes and process hierarchies, an editor for creating an operations manual and other manuals, document management, a section for indicators measuring the organization's operational performance and a tool for creating and analyzing feedback and reports. The usability is facilitated by additional functionalities related to communication between IMS users and the management of user rights. All these features

form a holistic, easy-to-use operating system. In Belgium Syntra West must comply with the ISO 9001:2008 standard. While this provides interesting information regarding the present approach to Quality management, it also indicates that there is no immediate need to make the proposed PLM software compatible with any specific existing quality management system.

In relation to general technical specifications it is clear that the PLM software should be compatible with MS SQL Systems, it should be compatible with Microsoft XP and Microsoft windows operating systems developed since then and with windows servers. It should have a clear and easy to use graphical user interface. Perhaps there would be merit in having a web based user interface with a windows / SQL backend.

In relation to functionality if PLM runs on MS SQL, it is important to have detailed documentation on tables and table-relations, field mapping, etc. It should be an open source based application. Exporting of data should be possible, for example to Microsoft Excel. The software should be capable of printing reports in both text (including pdf) and graphical formats. It should be possible for the user to customise these reports. And most importantly, the software should be as easy to use as possible with a clear user friendly graphic interface.

Again it has to be stressed that at all stages of use the software must assume that the user is not an IT specialist so a clear graphic presentation providing ease of use is essential.

Following the completion of the questionnaire, some additional discussions were held between the project partners in relation to software functionality. A number of additional functional specifications were raised at this time. These include the ability to give a weighting to each indicator so that indicators that are not important to a particular organisation, or indeed indicators of critical importance, can be given due recognition in the PLM process. A default value for indicators should be set within the system for organisations who do not wish to customise the indicator weighting. Once a weighting is set within the system it should be possible to save this for future use or future editing.

Key success factors will carry a weighting based on the weight assigned to the individual indicators assigned to them. That is that the weight of a key success factor will be the combined weighting of the indicators assigned to it divided by the number of indicators assigned to it.

7.2 Target groups of the Q-PLM software

The PLM-software should be used for the coordination of training programs in the VET market and for the control of the processes and product portfolios of the training providers, thus making it easier to monitor and better visualize the business processes and the VET offers and products.

Within the Q-PLM project some hundred European target groups and stakeholders, who should guarantee a sustainable use and exploitation of the project, could be identified within an exploitation questionnaire. The main target groups and stakeholders proposed by the partnership for the exploitative use of the project are the following ones:

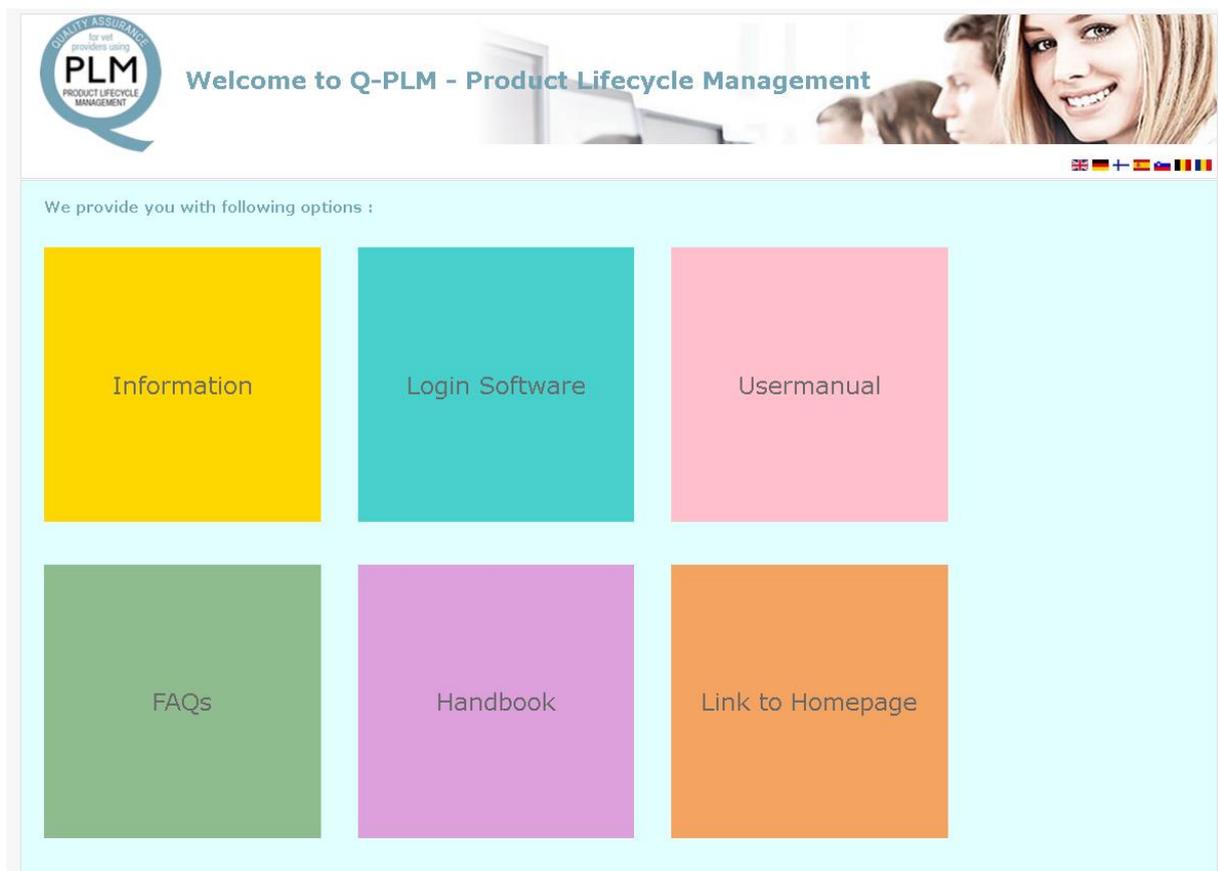
- European networks for the quality assurance in VET, like the EQARF (The European Quality Assurance Reference Framework)
- European VET- providers at all levels (professional schools, vocational education providers, universities of applied sciences, universities, postgraduate universities,...)
- VET providers at all geographic levels: local, regional, national, European
- European project managers
- VET providers participating in European projects
- National Agencies
- National boards of education and training
- Management staff in VET organizations
- Head of departments in VET organizations
- Head of training centres, schools, universities
- Product developers for VET programs
- Competence centres in VET
- Marketing managers in the VET sector
- Members of the national feedback panels
- Members and stakeholders of the partner organizations
- Staff in the partner organizations
- Academics and researchers
- Trainers and teachers
- Associations, associated partners of all partner organizations
- Professional associations
- Public authorities
- Research centres
- Social partners and unions
- Governmental and non-governmental organizations

7.3 Use and application of the Q-PLM software

The Welcome page of the software provides you with different options:

- Information: A short information about the project and its aims.
- Logon Software: The login-page for the Q-PLM database
- User manual: A link to the manual for the Q-PLM-database (this section of the handbook)
- FAQs : A list of frequently asked questions
- Handbook: A link to this handbook
- Link to Homepage: A link to the official project homepage.

You can change the language in the right upper corner via small icons.



Login

By clicking “Login Software” on the homepage you will be able to login to the Q-PLM Database.

You enter your Loginname and your Password and clicked on ‘button “Login” you will enter the software. If you don’t have loginname and password yet, ask the administrator of your organisation, who is responsible for the software to provide you an login.

If you filled in a wrong username or password you will get the message “Your login failed!”. Click the button “Back to Login” to get back to the Login.



The screenshot shows the login page for Q-PLM. At the top left is the PLM logo with the text 'QUALITY ASSURANCE for all providers using PLM PRODUCT LIFECYCLE MANAGEMENT'. To the right is the text 'Welcome to Q-PLM - Product Lifecycle Management' and a small image of people. Below this is a row of flags and social media icons. The main content area is titled 'Login Q-PLM Test-Database' and contains a form with the following fields:

- Language for Logon: English (en) (dropdown menu)
- Loginname: (text input field)
- Password: (password input field)
- Login (button)

Product and Rating

After successful login you will see more or less tabs appropriate to your user level.

The first is “Product & Rating” where you can create new products to be rated, change existing products and also create and change ratings for a product.

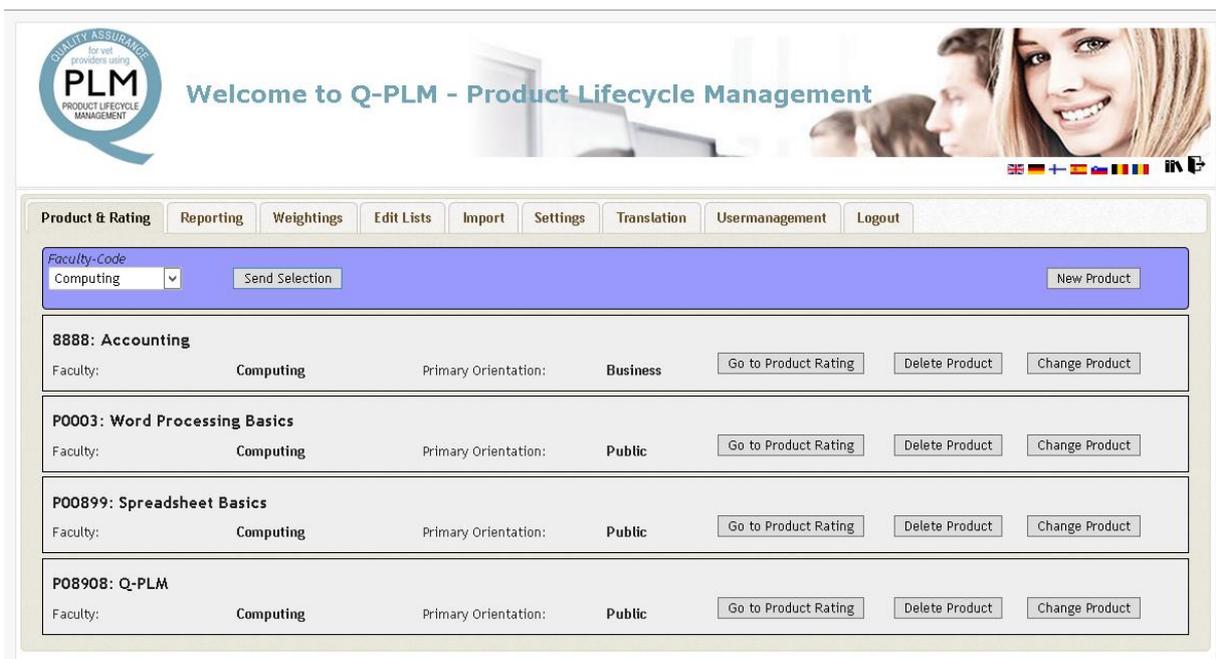
On this panel you can

- Create a new product
- Edit an existing product
- Rate a product
- Delete a product

If you list of products is already very long you are able to limit the list through a “Faculty Code”.

First of all you would like to create a new product. For this click on the button “New Product” on the right side of the blue panel.

This is not the only way to get products, you can also import them, as described in a further chapter.



Welcome to Q-PLM - Product Lifecycle Management

Product & Rating | Reporting | Weightings | Edit Lists | Import | Settings | Translation | Usermanagement | Logout

Faculty-Code: Computing [Send Selection] [New Product]

8888: Accounting	Faculty: Computing	Primary Orientation: Business	[Go to Product Rating]	[Delete Product]	[Change Product]
P0003: Word Processing Basics	Faculty: Computing	Primary Orientation: Public	[Go to Product Rating]	[Delete Product]	[Change Product]
P00899: Spreadsheet Basics	Faculty: Computing	Primary Orientation: Public	[Go to Product Rating]	[Delete Product]	[Change Product]
P08908: Q-PLM	Faculty: Computing	Primary Orientation: Public	[Go to Product Rating]	[Delete Product]	[Change Product]

After you clicked “New Product” you can enter data of your product. These are

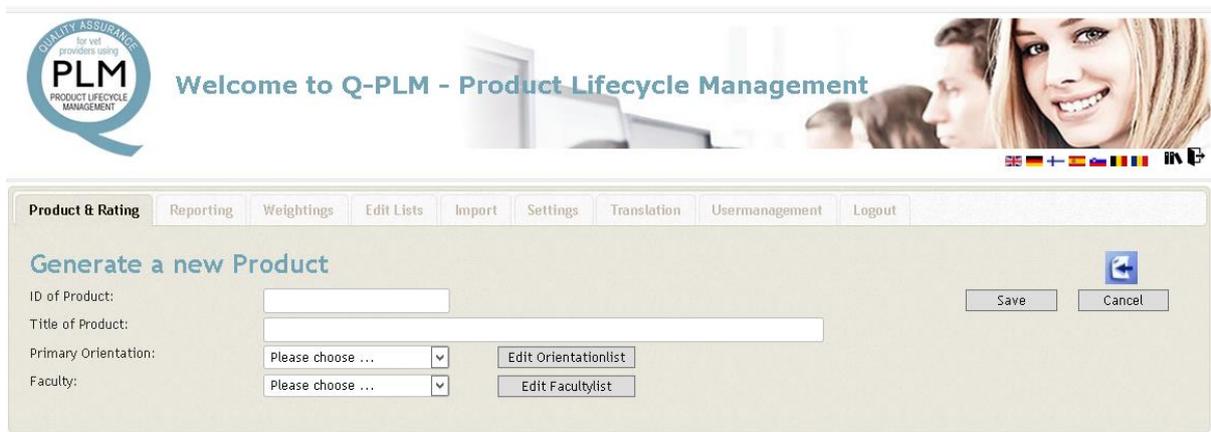
- ID of Product: A product number as you use it in your organisation, this number may also contain letters
- Title of Product: the Name or description of your product
- Primary Orientation: a first value to organise your product list. You can only use values from the select list.
- Faculty Code: a second value to organise your product list. You can only use values from the select list.

All four values are mandatory, so you have to choose at least one “Primary Orientation” and one “Faculty List”.

After you finished with entering data click on button “Save” to save the new product. You can also leave without saving by clicking “Cancel”.

If you are logged in as a “Manager” you will be able to work both of this lists “Primary Orientation” and “Faculty Code” in this case you will see the buttons “Edit Orientation List” and “Edit Faculty List” beside the select lists. How to work on this list will be topic of the further chapter “Edit Lists”.

If in your organisation you don’t use “Primary Orientation” or “Faculty List” you can change this by simple rename it through the translation feature. How to translate will also be described in a further chapter “Translation”



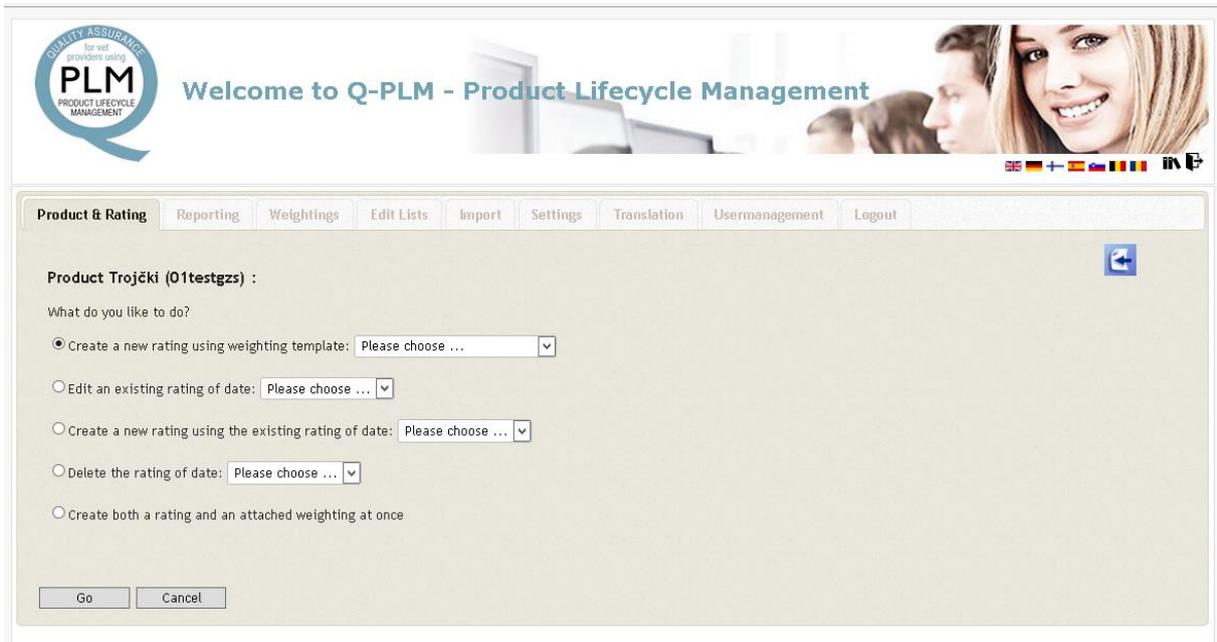
The screenshot shows the Q-PLM web interface. At the top, there is a banner with the PLM logo and the text "Welcome to Q-PLM - Product Lifecycle Management". Below the banner is a navigation menu with tabs: Product & Rating, Reporting, Weightings, Edit Lists, Import, Settings, Translation, Usermanagement, and Logout. The main content area is titled "Generate a new Product" and contains a form with the following fields and buttons:

- ID of Product:
- Title of Product:
- Primary Orientation:
- Faculty:

At the bottom right of the form are "Save" and "Cancel" buttons.

After you are back to the main product list you will see your new product on top of the list. Here you can change the product data by simple click on the button “Change Product” on the left side of the products panel. You will get a very similar form as for creating a product, where you can change and save your product settings.

You can delete a product by clicking on the button “Delete Product”. You would have to confirm the deletion. Be aware, that if you have already made ratings on a product, also this ratings will be deleted. There is now way to get back data you deleted.

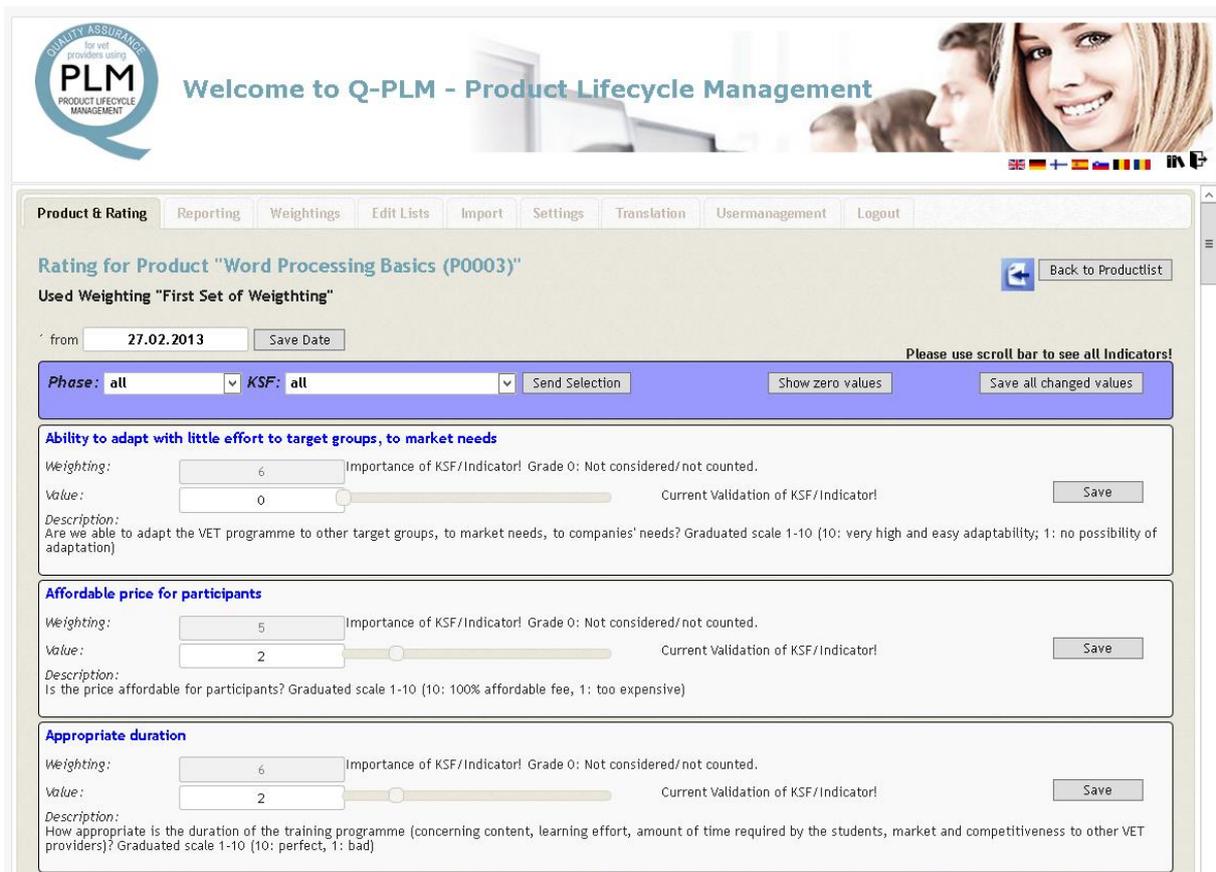


The main work on products is to create on or more ratings. To start rating for a product click “Go to Product Rating”. You will not go immediately to a rating form but you have to choose first, what you want to do. Here you have four options (if you are logged in as a “Manager” you got a fifth option)

- Create a new rating using a weighting
Weightings are provided by users who are “Managers”
- Edit an existing rating for this product
- Create new rating by using an existing rating for this product.
- Delete a rating
- And if you are “Manager”: Create both a rating and an attached weighting at once.

Choose an option and select a weighting form the list beside the option and click on Button “Go”. Click Button “Cancel” to go back to the main list of products.

In case of you chose of the first three options you will get a similar form to change and save the ratings for each indicator.



The screenshot shows the Q-PLM web interface. At the top, there is a navigation menu with tabs: Product & Rating, Reporting, Weightings, Edit Lists, Import, Settings, Translation, Usermanagement, and Logout. The main content area is titled "Rating for Product 'Word Processing Basics (P0003)'" and shows "Used Weighting 'First Set of Weighting'". A date field is set to "27.02.2013" with a "Save Date" button. Below this, there are dropdown menus for "Phase: all" and "KSF: all", along with buttons for "Send Selection", "Show zero values", and "Save all changed values". The interface displays three indicators with their respective weighting and value fields:

- Ability to adapt with little effort to target groups, to market needs:** Weighting: 6, Value: 0. Description: "Are we able to adapt the VET programme to other target groups, to market needs, to companies' needs? Graduated scale 1-10 (10: very high and easy adaptability; 1: no possibility of adaptation)".
- Affordable price for participants:** Weighting: 5, Value: 2. Description: "Is the price affordable for participants? Graduated scale 1-10 (10: 100% affordable fee, 1: too expensive)".
- Appropriate duration:** Weighting: 6, Value: 2. Description: "How appropriate is the duration of the training programme (concerning content, learning effort, amount of time required by the students, market and competitiveness to other VET providers)? Graduated scale 1-10 (10: perfect, 1: bad)".

On the rating form you will see the title of the product and the name of the weighting you chose.

Each ratings is attached to a date. If the rating is created you get the current date attached. You can easily change the date to your own choice by entering a different date near "from" and click on button "Save Date". You will have to confirm this change.

Is you want to go back to the product list click on button "Back to Productlist". You will get a note if you have left values for indicators at zero.

For each indicator, in the initial version about 50, you can enter a value between zero and ten. If you set the value to zero means, that you don't need this indicator in your rating for this product. Zero means, that this indicator will not account for any report of this product.

So you will have to choose values between one and ten if you want this indicator to show up in a report for this product. One is the lowest rating, ten is the highest rating.

If you created a completely new rating all values starts with zero.

The weighting is also shown in this rating. Both weighting and rating will be used in reporting. The value you get in reporting is simply the product of weighting and rating. The weighting shows how important this indicator is for your organisation, the rating shows how well this indicator is fulfilled. So if the weighting is high you will have attention to this indicator and also look after a high value. If the weighting is low you may have less attention to this

indicator, because in a report the calculated value, the product of weighing and value, will not grow big even if the value you entered is big.

You cannot change the weighting in the stage of rating a product. You must be “Manager” to be able to do both.

You can enter the value as a number or use the slider beside.

After you entered a value you can save it by clicking on button “Save” in the panel of the indicator. Which indicator you changed and not saved yet is shown by a reddish colour in the background of the indicators panel. You also can first change all indicators and then save them at once using the button “Save all changed Values” on the top of the indicator list.

You can use three filter to on the list of indicators. You can set this filters through select lists and buttons positioned on to top of the list.

- Phase: choose one of the four phases and click “Send Selection”
- KSF: choose one of the ten Key Success Factors and click “Send Selection”
- Click the button “Show zero Values” if you want to see only those indicators you have not rated yet.

You can set all three filters contiguous.

Reporting

The second main part of the evaluation process and therefore of the software is the reporting and comparison of the ratings different products and different stages of a product.

In the software this is realized by two concepts: Filters and Grouping

- Filter: you can select one or more filters to limit the result of the report to a product, a phase, a key success factor, a period and so on
- Grouping: how should the result be presented? Do you want to break down the report to phases, key success factors or indicators? Or do you want to combine two of this? Or do you want to compare the ratings of two products? Or of one product in different stages?



Welcome to Q-PLM - Product Lifecycle Management



- Product & Rating
- Reporting**
- Weightings
- Edit Lists
- Import
- Settings
- Translation
- Usermanagement
- Logout

- Compare Evaluations of one Product
- Compare two Products
- Compare different Ratings of one Product
- Grouping

Compare Evaluations of one Product:

First choose Product: **Word Processing Basics**

Date: Use CTRL to choose more than one

- all
- 27.02.2013
- 28.10.2014

Filter :

Phase:
 Keysuccessfactor:
 Indicator:
 Date: to

- Show Report
- Show Values
- Print
- Export to Excel (as *.CSV)

Evaluation-Report on Selected Products with Filter on Product "Word Processing Basics":

Bar chart vertical Redraw Chart

Click to choose color of average value (bottom):

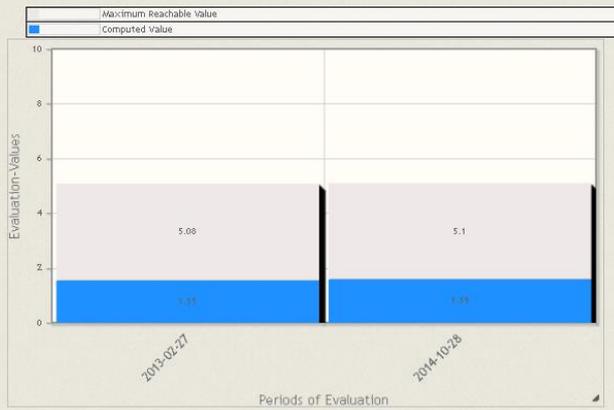


click to choose color of maximum reachable value (top):



Description	Average Value of Indicators	Average Maximum Reachable Value of Indicator	Number of Included Indicators
KSF1: Quality of VET Training :	1,75	5,77	26
KSF2: Customer Satisfaction :	1,28	4,78	18
KSF3: Quality of the Staff :	0,82	4,2	10
KSF4: Responding to Market Demands :	1,43	5,25	28
KSF5: Cost Control :	1,5	5	4
KSF6: Suitability of Infrastructure and Material :	4	5	2
KSF7: Stakeholder Engagement :	1,4	5	10
KSF8: Strategic Provider Benefits :	2,75	5	4
KSF9: Evaluation Mechanisms :	2,62	5	10
KSF10: Appropriate Certification :	1,23	5	8

Chart



Table

- Average lower than 50% of Maximum Reachable
- Average between 50% and 80% of Maximum Reachable
- Average higher than 80% of Maximum Reachable

Description	Average Value of Indicators	Average Maximum Reachable Value of Indicator	Number of included Indicators
2013-02-27	1,55	5,08	48
2014-10-28	1,59	5,1	50

You will have to get familiar with reporting to get the results you are interested in.

The results are shown both as a chart and as a table below. In the case you use “Grouping 1” and “Grouping 2” you will get the result only as a table.

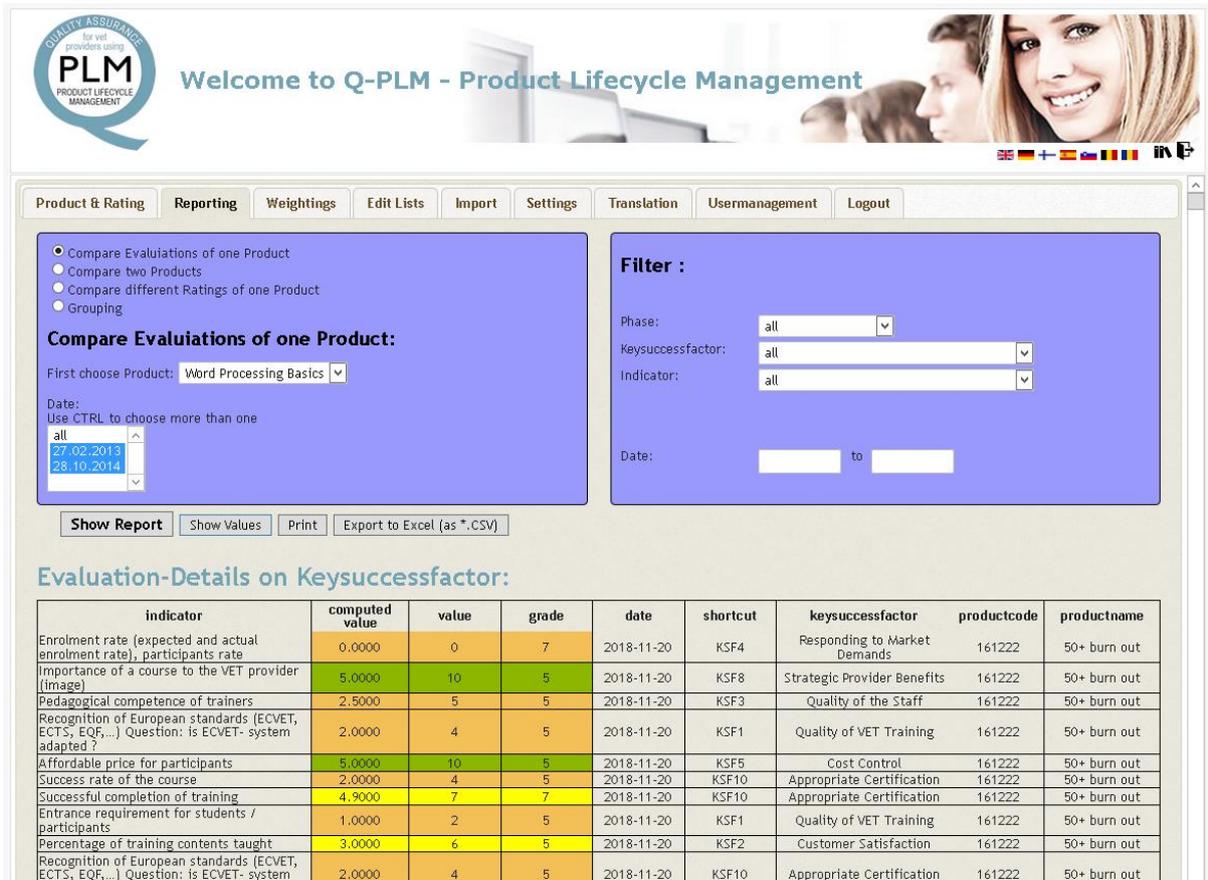
The chart shows the current result value in blue colour.

You can choose the kind of diagram by using the select list “Select chart”. You may choose between

- bar chart vertical
- bar chart horizontal
- line chart

The columns in the resulting table are:

- Description: the name or description of the result value
- Average value of indicators: all result values, that is value X weighting divided by 10, computed as an average of all single result values
- Average Maximum Reachable Value of Indicator: this is an average of all weightings or, if you want, the average of all products weighting X 10, the maximum value, divided by 10.
- Number of included Indicators: how many indicators are used to compute the values in the columns before.



Welcome to Q-PLM - Product Lifecycle Management

Product & Rating Reporting Weightings Edit Lists Import Settings Translation Usermanagement Logout

Compare Evaluations of one Product
 Compare two Products
 Compare different Ratings of one Product
 Grouping

Compare Evaluations of one Product:

First choose Product: Word Processing Basics

Date: Use CTRL to choose more than one
 all
 27.02.2013
 28.10.2014

Filter :

Phase: all
 Keysuccessfactor: all
 Indicator: all
 Date: to

Show Report Show Values Print Export to Excel (as *.CSV)

Evaluation-Details on Keysuccessfactor:

indicator	computed value	value	grade	date	shortcut	keysuccessfactor	productcode	productname
Enrolment rate (expected and actual enrolment rate), participants rate	0.0000	0	7	2018-11-20	KSF4	Responding to Market Demands	161222	50+ burn out
Importance of a course to the VET provider (Image)	5.0000	10	5	2018-11-20	KSF8	Strategic Provider Benefits	161222	50+ burn out
Pedagogical competence of trainers	2.5000	5	5	2018-11-20	KSF3	Quality of the Staff	161222	50+ burn out
Recognition of European standards (ECVET, ECTS, EQF,...) Question: is ECVET-system adapted?	2.0000	4	5	2018-11-20	KSF1	Quality of VET Training	161222	50+ burn out
Affordable price for participants	5.0000	10	5	2018-11-20	KSF5	Cost Control	161222	50+ burn out
Success rate of the course	2.0000	4	5	2018-11-20	KSF10	Appropriate Certification	161222	50+ burn out
Successful completion of training	4.9000	7	7	2018-11-20	KSF10	Appropriate Certification	161222	50+ burn out
Entrance requirement for students / participants	1.0000	2	5	2018-11-20	KSF1	Quality of VET Training	161222	50+ burn out
Percentage of training contents taught	3.0000	6	5	2018-11-20	KSF2	Customer Satisfaction	161222	50+ burn out
Recognition of European standards (ECVET, ECTS, EQF,...) Question: is ECVET-system	2.0000	4	5	2018-11-20	KSF10	Appropriate Certification	161222	50+ burn out

Click on button "Show Report" to show the results.

At the panel on the left side you can choose the filters you need. Please fill free to set all combinations of filters. The more filters you set the more restricted the result will be.

At the panel of the left side you choose the presentation of the result. You have three options:

- Compare Evaluations of one Product: choose a product and the ratings to compare
- Compare two Products: choose two products to compare
- Compare different Ratings of one Product: choose ratings of different date of one product to compare
- Grouping: simple report of one result set or two result sets combined.
Default: one result set broken down on key success factors.

- Compare Evaluations of one Product
- Compare two Products
- Compare different Ratings of one Product
- Grouping

Compare Evaluations of one Product:

First choose Product:

Date:
Use CTRL to choose more than one

If you select the option “Compare Evaluations of one Product” you have to choose a products and the ratings of this product to compare to compare with.



The screenshot shows a web application interface with a navigation bar at the top containing: Product & Rating, Reporting, Weightings, Edit Lists, Import, Settings, Translation, Usermanagement, and Logout. The main content area is split into two panels. The left panel, titled 'Compare Evaluations of one Product:', contains a list of options (Compare Evaluations of one Product, Compare two Products, Compare different Ratings of one Product, Grouping), a dropdown menu for 'First choose Product' set to 'Word Processing Basics', and a date selection section with a list of dates: 'all', '27.02.2013', and '28.10.2014'. The right panel, titled 'Filter:', contains three dropdown menus for 'Phase', 'Keysuccessfactor', and 'Indicator', all set to 'all', and a date range selector with two empty input boxes and a 'to' label between them.

If you select the option “Compare two Products” you have to choose two products to compare with. You will get two results, a chart and a table for each of the products. You may choose a special date of a rating, if you want to compare only two ratings and not all ratings combined.

You can also choose the grouping for this report. The available options are:

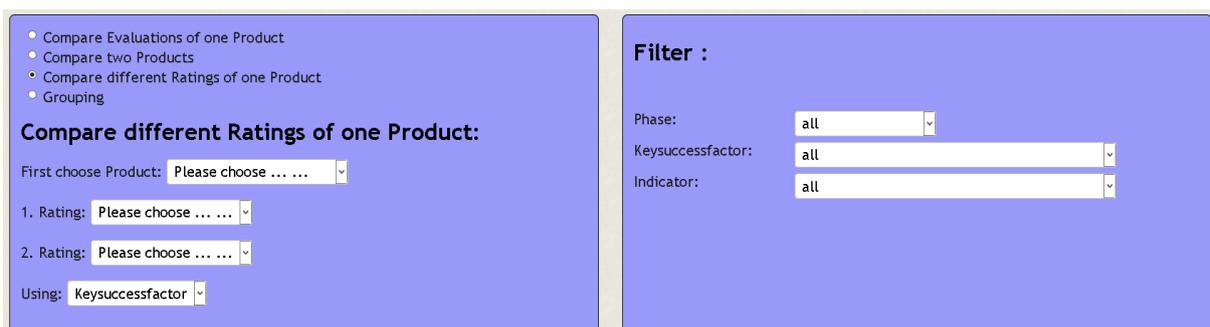
- Keysuccessfactor
- Phase
- Indicator



If you select the option “Compare different Ratings of one Product” you have to choose two date of Ratings to compare with. You will get two results, a chart and a table for each rating.

You can also choose the grouping for this report. The available options are:

- Keysuccessfactor
- Phase
- Indicator



If you choose “Grouping” you have to choose at least one value from the select list “Grouping 1”, default is “Keysuccessfactor”. You may choose between the options:

- Keysuccessfactor
- Phase
- Indicator
- Product
- Faculty
- Primary Orientation
- Date

If you choose only a value from “Grouping 1” the result will be broken down at this value and the result is shown in a chart and a table below.

If you choose from both “Grouping 1” and “Grouping 2” values will be taken into account and the result will be a table only.

If you choose “Date” for grouping you may choose between three options the brake down the result:

- Month
- Quarter
- Year

- Compare Evaluations of one Product
- Compare two Products
- Compare different Ratings of one Product
- Grouping

Grouping :

Grouping 1:

Grouping 2:

Filter :

Product: Date:

Phase:

Keysuccessfactor:

Indicator:

Faculty:

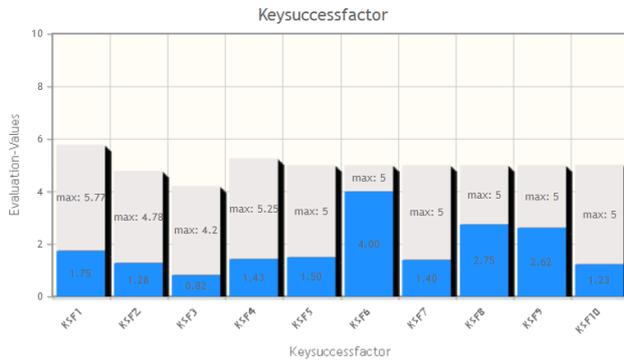
Primary Orientation:

Date: to

If you got a result after clicking on button “Show Report” you three get more buttons.

Click on button “Show Values” to get the list of all included indicators and their values and weightings set for this report. The “computed value” is the product of value X weighting divided by 10.

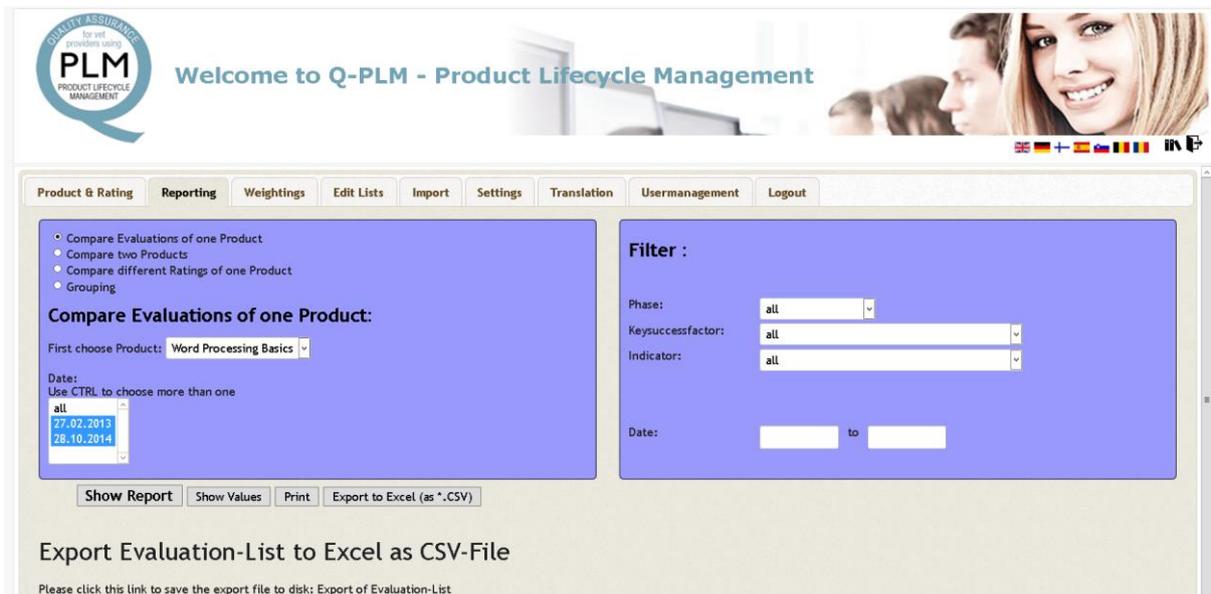
Evaluation-Report on Keysuccessfactor with Filter on Product "Word Processing Basics":



Description	Average Value of Indicators	Average Maximum Reachable Value of Indicator	Number of included Indicators
KSF1: Quality of VET Training :	1.75	5.77	26
KSF2: Customer Satisfaction :	1.28	4.78	18
KSF3: Quality of the Staff :	0.82	4.2	10
KSF4: Responding to Market Demands :	1.43	5.25	28
KSF5: Cost Control :	1.5	5	4
KSF6: Suitability of Infrastructure and Material :	4	5	2
KSF7: Stakeholder Engagement :	1.4	5	10
KSF8: Strategic Provider Benefits :	2.75	5	4
KSF9: Evaluation Mechanisms :	2.62	5	10
KSF10: Appropriate Certification :	1.23	5	8

You may click on button “Print” to get a printable version of the report. Here click on “Print” to print at a printer or export it to a pdf-file.

Click on Button “Close Window/Tab” to get back to the original report.



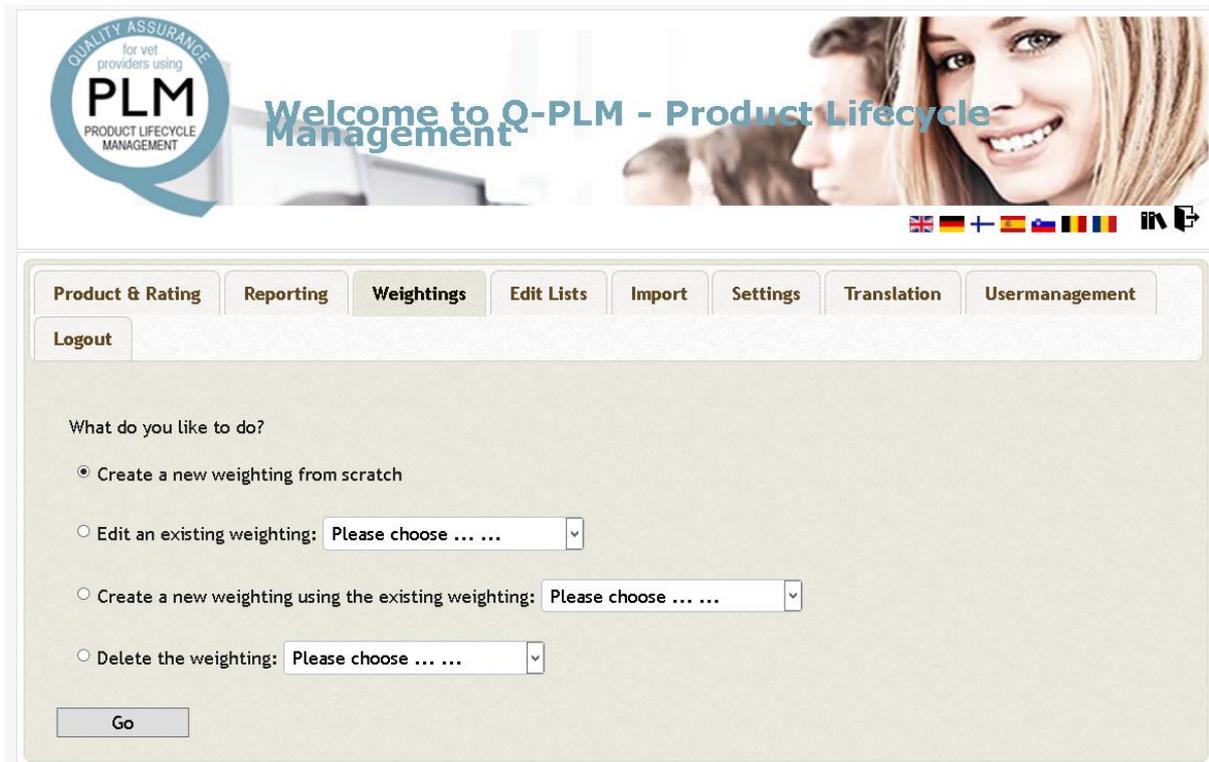
You may click on button “Export to Excel (as *.CSV)” to get an export file you can use with Microsoft Excel or another spreadsheet application. After you clicked the button an export-file is created. Click the link “Export of Evaluation-List” to download this file.

If Microsoft Excel is installed on your computer, CSV files are opened in Excel by default.

Weightings

If you are logged in as a “Manager” you will be able to create new weightings for indicators. Weightings are used to rate how important an indicator is for the organisation.

Weightings are edited similar to ratings or a products described in the chapter “Product and Rating”.



The screenshot shows the Q-PLM - Product Lifecycle Management interface. At the top, there is a banner with the PLM logo and the text "Welcome to Q-PLM - Product Lifecycle Management". Below the banner is a navigation menu with tabs: Product & Rating, Reporting, Weightings (selected), Edit Lists, Import, Settings, Translation, and Usermanagement. A Logout button is also visible. The main content area asks "What do you like to do?" and provides four options:

- Create a new weighting from scratch
- Edit an existing weighting: Please choose
- Create a new weighting using the existing weighting: Please choose
- Delete the weighting: Please choose

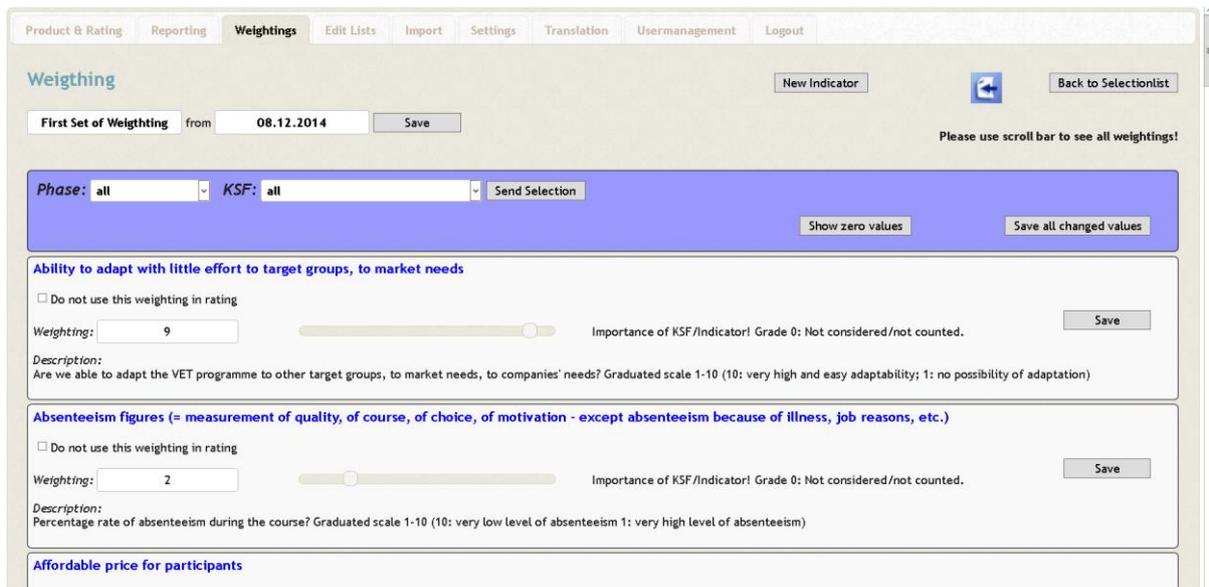
A "Go" button is located at the bottom of the form.

If you click on the tab you are asked what you like to do:

- Create a new weighting from scratch
- Edit an existing weighting
- Create new weighting by using an existing weighting.
- Delete a weighting

Choose an option and select a weighting form the list beside the option and click on Button “Go”.

In case of you chose of the first three options you will get a similar form to change and save the weightings for each indicator.



On the rating form you will see the name of the weighting and its creation date.

Each weighting is attached to its name. If the rating is created you get a default name and the current date is attached. You can change the name and date to your own choice by typing appropriate values and clicking on button “Save”.

For each indicator, in the initial version about 50, you can enter a value between zero and ten. If you set the value to zero means, that you don’t need this indicator in the rating of your products. Weighting zero means that this indicator will not account for any report.

So you will have to choose values between one and ten if you want this indicator to show up in a report for this product. One is the lowest rating, ten is the highest rating.

If you created a completely new weighting all values starts with zero.

You can enter the value as a number or use the slider beside.

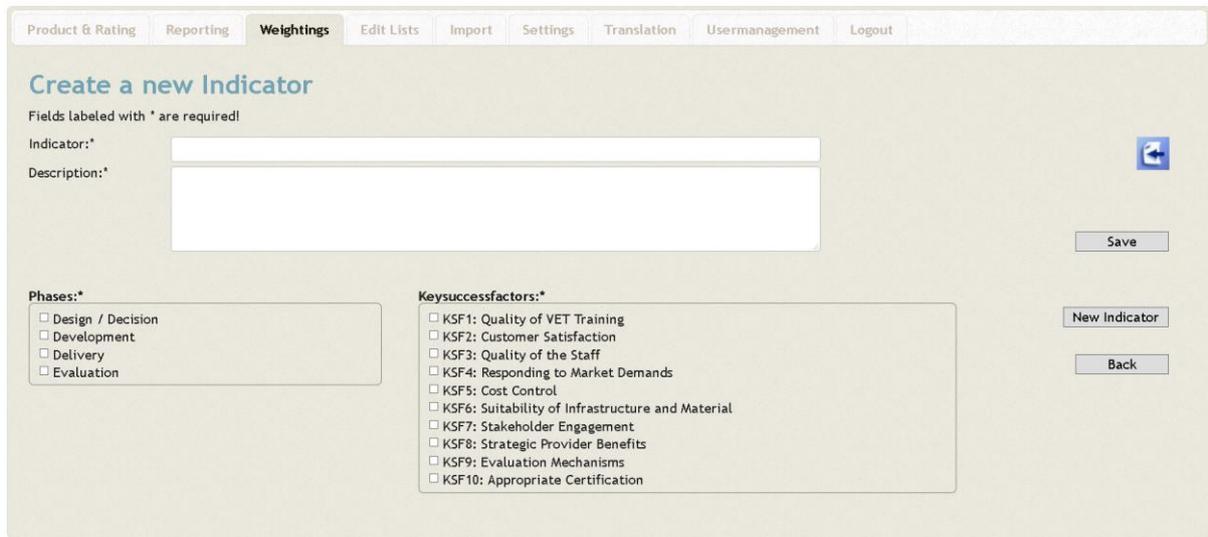
After you entered a weighting you can save it by clicking on button “Save” in the panel of the indicator. Which indicator you changed and not saved yet is shown by a reddish colour in the background of the indicators panel. You also can first change all indicators and then save them at once using the button “Save all changed Values” on the top of the indicator list.

You can use three filter to on the list of indicators. You can set this filters through select lists and buttons positioned on to top of the list.

- Phase: choose one of the four phases and click “Send Selection”
- KSF: choose one of the ten Key Success Factors and click “Send Selection”
- Click the button “Show zero Values” if you want to see only those indicators you have not rated yet.

You can set all three filters contiguous.

By clicking on the button “New Indicator” you can add a new indicator and add it to one or more phases and key success factors.



The screenshot shows the 'Create a new Indicator' form. At the top, there is a navigation bar with tabs: Product & Rating, Reporting, **Weightings**, Edit Lists, Import, Settings, Translation, Usermanagement, and Logout. Below the navigation bar, the title 'Create a new Indicator' is displayed. A note states 'Fields labeled with * are required!'. The form contains several input fields: 'Indicator:*' and 'Description:*' (both empty text boxes), 'Phases:*' (a list of checkboxes for Design / Decision, Development, Delivery, and Evaluation), and 'Keysuccessfactors:*' (a list of checkboxes for KSF1 through KSF10). On the right side of the form, there are three buttons: 'Save', 'New Indicator', and 'Back'.

Click button “Back to Select List” to get back to the main page of weighting.

Edit Lists

The software comes with two lists to organise your products:

- Primary Orientation
- Faculty Code

On this tab you can add and change the values for this lists. You must be logged in as “Manager” to be able to edit this lists.



The screenshot shows the 'Edit Lists' page. At the top, there is a navigation bar with tabs: Product & Rating, Reporting, Weightings, **Edit Lists**, Import, Settings, Translation, Usermanagement, and Logout. Below the navigation bar, the title 'Choose a List for Editing:' is displayed. There are two buttons: 'Edit Primary Orientation' and 'Edit Faculty Code'. On the right side of the page, there is a logo for 'Q-PLM Quality Assurance for VET Providers Using Product Lifecycle Management'.

Click button “Edit Primary Orientation” to edit the Primary Orientation list, click button “Edit Faculty Code” to edit the Faculty Code list.



The screenshot shows a web interface with a navigation menu at the top: Product & Rating, Reporting, Weightings, **Edit Lists**, Import, Settings, Translation, Usermanagement, Logout. Below the menu is a blue box titled "Choose a List for Editing:" containing two buttons: "Edit Primary Orientation" and "Edit Faculty Code". The "Edit Primary Orientation" button is selected. Below this is the "Edit Primary Orientation" section with a table of entries:

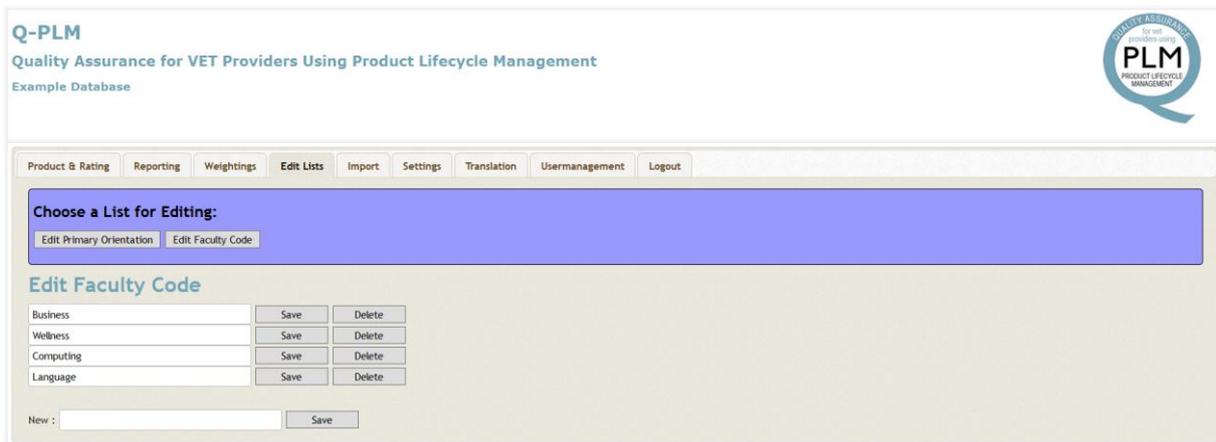
Public	Save	Delete
Business	Save	Delete

At the bottom, there is a "New:" input field and a "Save" button.

To edit an existing entry overwrite the existing value and click on button "Save" beside.

To delete an entry click the button "Delete" beside.

To add a new entry type in a new value near "New:" and click button "Save".



The screenshot shows the "Q-PLM Quality Assurance for VET Providers Using Product Lifecycle Management" interface. The navigation menu is the same as in the previous screenshot. The "Edit Faculty Code" button is selected in the "Choose a List for Editing:" box. Below is the "Edit Faculty Code" section with a table of entries:

Business	Save	Delete
Wellness	Save	Delete
Computing	Save	Delete
Language	Save	Delete

At the bottom, there is a "New:" input field and a "Save" button.

You may even delete an entry if it is used with products. The products save their own values and will keep the value even if this is not in the list.

Therefore if you change an entry here it will not automatically be changed at a product. You must edit the product and attach the appropriate value from the select list.

Import

If you want to rate many products and you already have your list of products you may easily import it through this feature.

You must be logged in as “Manager” to use this feature.

The file you upload must be simple text with delimiter semicolon like this

```
ProductID;Productname;Orientation;Faculty  
P1234Z;Q-PLM Introduction;Public;Computing
```

The first row of the file to import must consist of this column names:

```
ProductID;Productname;Orientation;Faculty
```

If the first row is not of this kind, the import file will be rejected.

Use the file type CSV to export it from your application and it will be appropriate. Make sure that the encoding of the file is “utf8” or you will get problems with language specific letters. Notice, that Excel will export by default with encoding “ANSI”, which will not work.



Click on button “Select File” to select the file you want upload from your computer.

Click button “Upload” to upload the file. You will get a preview. Here you can review the upload and see, if all language specific letters are shown in the right way. If not change the file and try it again. Do not click on button “Import” before the preview is not appropriate.

Click on button “Import” to finish the upload.

New values for the lists “Primary Orientation” and “Faculty Code” will automatically be extracted from the third and fourth column of the imported file and are added to this lists

Settings

On this tab you can choose your language whenever you log in.



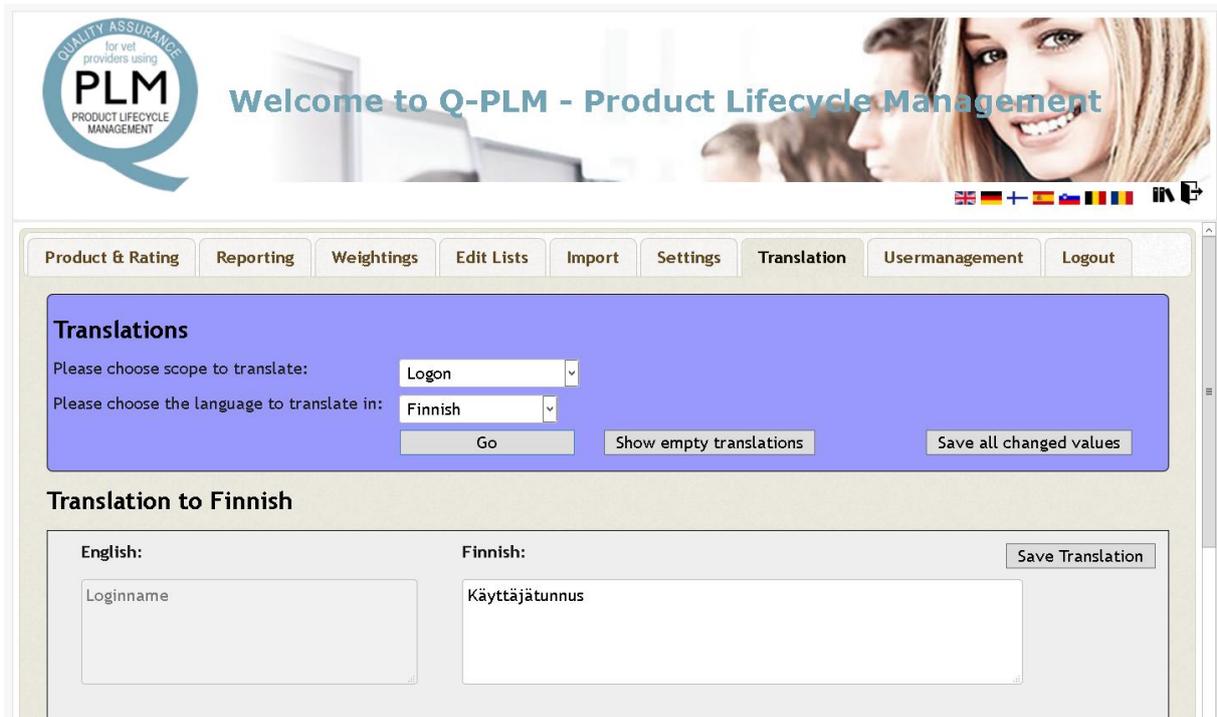
The screenshot shows the 'Settings' tab of the Q-PLM interface. At the top, there is a banner with the PLM logo and the text 'Welcome to Q-PLM - Product Lifecycle Management'. Below the banner is a navigation bar with tabs: 'Product & Rating', 'Reporting', 'Weightings', 'Edit Lists', 'Import', 'Settings', 'Translation', 'Usermanagement', and 'Logout'. The 'Settings' tab is active. In the main content area, there is a 'Select a Language:' label followed by a dropdown menu currently showing 'English (en)'. Below the dropdown is a 'Save' button. To the right of the dropdown, there are small icons for various languages and a help icon.

Choose a language from the select list. Click on button “Save” to change the language of the software. This language is also used with your next login.

Only languages are provided, that are added by a user who is “Manager”.

Translation

If you are logged in as a “Manager” you can add a new language and add translations to all parts of the software. You are able to translate the descriptions of the user frontend, the phases, key success factors and indicators.



The screenshot shows the Q-PLM translation interface. At the top, there is a banner with the PLM logo and the text "Welcome to Q-PLM - Product Lifecycle Management". Below the banner is a navigation menu with tabs: Product & Rating, Reporting, Weightings, Edit Lists, Import, Settings, Translation (selected), Usermanagement, and Logout. The main content area is titled "Translations" and contains two dropdown menus: "Please choose scope to translate:" (set to "Logon") and "Please choose the language to translate in:" (set to "Finnish"). Below these are buttons for "Go", "Show empty translations", and "Save all changed values". The "Translation to Finnish" section shows a table with two columns: "English:" and "Finnish:". The "English:" column contains the text "Loginname" and the "Finnish:" column contains "Käyttäjätunnus". A "Save Translation" button is located to the right of the "Finnish:" column.

First choose the scope you want to translate from the first select list, the language you want to add translations. Click on button “Select” to show a list of all phrases to translate.

On the left side you will get the phrase in English, on the right side you may enter or change the translation in your language. Click button “Save Translation” to save the translation.

You may use the button “Show empty Translations” at the top of the list to show only those phrases where the translation is missing.

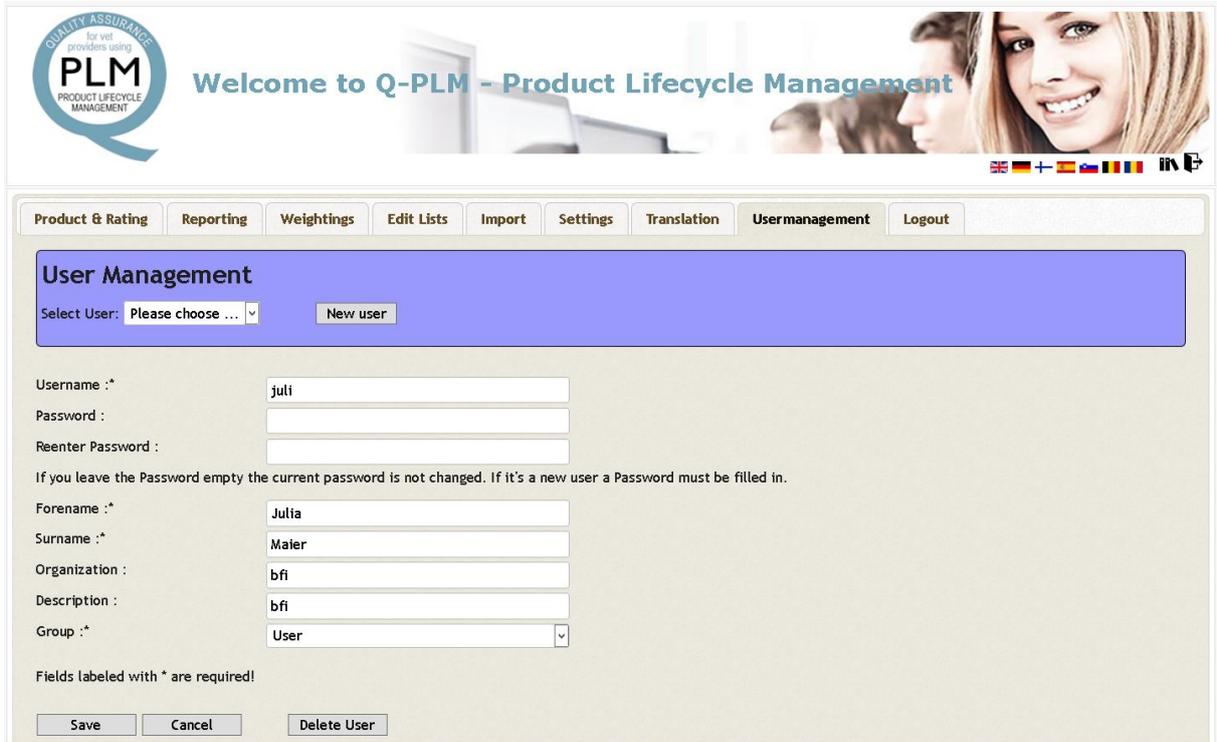
You may first enter all translations and then click on button “Save all changed values” on the top of the list.

If you don’t enter a translation for a phrase the English phrase is used.

If you want to add a new language click on button “New Language”. Here you can enter a new language to the language list.

User management

If you are logged in a “Manager” you can add, change and delete users.



The screenshot shows the Q-PLM web application interface. At the top, there is a banner with the PLM logo and the text "Welcome to Q-PLM - Product Lifecycle Management". Below the banner is a navigation menu with tabs: Product & Rating, Reporting, Weightings, Edit Lists, Import, Settings, Translation, **Usermanagement**, and Logout. The "User Management" section is active, showing a form for adding or editing a user. The form includes a "Select User" dropdown menu with "Please choose ..." and a "New user" button. The form fields are: Username (*), Password, Reenter Password, Forename (*), Surname (*), Organization, Description, and Group (*). The current values are: Username: juli, Password: (empty), Reenter Password: (empty), Forename: Julia, Surname: Maier, Organization: bfi, Description: bfi, Group: User. A note states: "If you leave the Password empty the current password is not changed. If it's a new user a Password must be filled in." At the bottom, there are buttons for "Save", "Cancel", and "Delete User".

Select a user from the list of existing users to change its values.

If you want to add a new user click button “New User”

Username, Forename, Surname and Group are mandatory, also the Password if add a new user.

You may choose between three groups:

- Manager: can do everything in the software
- User: is able to add new products, do ratings and do reports
- Reporter: is able to do reports

If you do not enter a new password, the password will not be changed.

If you enter a password you have to re-enter it. This is for security reasons.

Click button “Save” to save the changes.

Click button “Cancel” to cancel all changes

To delete a user first choose of from the list of users and then click button “Delete”. You must confirm the deletion.

Logout

Click on button “Logout” if you want to logout form the software.



The screenshot shows the Q-PLM software interface. At the top left is the PLM logo with the text "QUALITY ASSURANCE for vet providers using PLM PRODUCT LIFECYCLE MANAGEMENT". To the right is a banner image of a smiling woman with the text "Welcome to Q-PLM - Product Lifecycle Management". Below the banner is a navigation menu with buttons for "Product & Rating", "Reporting", "Weightings", "Edit Lists", "Import", "Settings", "Translation", "Usermanagement", and "Logout". The "Logout" button is highlighted. Below the menu is a confirmation dialog box with the text "Do really want to logout?" and a "Logout" button.

8 Summary and conclusion

Active product lifecycle management, including the use of suitable PLM software, is a tool to monitor and control the product portfolio of an educational institution. It can be recommended not only for reasons of quality assurance, but also for the facilitation of product development, for more transparency in the strategic business areas and, last but not least, for the maintenance of the competitiveness of VET providers. Services and products on the vocational education and training (VET) market are being influenced by a vast number of factors and variables. VET products have a certain product lifecycle, as do all products on the economic market – and PLM is a conceptual approach which takes into consideration the entire lifetime of a product. A PLM software system enables VET providers to facilitate the control of product life cycles and to manage the wide range of product data in an efficient way. Optimally coordinated processes across multiple locations allow a quick response to changes in market demand. Thus, the right product, at the right time, is brought to market at the right price.

PLM-software should be used for the coordination of training programmes in the VET market and for the control of the processes and product portfolios of the training providers, thus making it easier to monitor and better visualize the business processes and the product.

In general, the sustainable use of a European project can only be successful through close cooperation of all the partners involved. Not only the communication but also the individual use of national dissemination channels, contacts and networks, can have great influence on the sustainable impact of a project. The partners of the Q-PLM project have excellent networks and contacts to all the potential groups of stakeholders in the partner countries.

The project's main objective was to, in an adapted form, transfer the product lifecycle management that is primarily being used in the industrial and IT area to the field of further education. Active PLM facilitates product control, planning, adaptation and innovation, thus enabling a market-orientated approach of the portfolios in further education. This project foresees the development of an IT-based tool for an integrated product lifecycle management for VET providers.

8.1 PLM in VET as a chance

Active product lifecycle management, including the use of suitable PLM software, is a useful tool for monitoring and controlling the product portfolio of an educational institution. It can be recommended not only for reasons of quality assurance, but also for the facilitation of the product development, for more transparency in the strategic business areas and, last but not least, for the maintenance of the competitiveness of VET providers. There is a high demand for a coherent and practical instrument for the monitoring the lifecycles of VET products, with consideration to several key success factors and indicators influencing vocational training and education programmes.

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