WMS-market 2006-2007

An international study

The whole IT branch, including Warehouse Management Systems, is enhanced faster and faster. Even specialists have difficulties in being constantly informed about all relevant developments. Hence, the Supply Chain Group – in Germany represented by IWL AG – presents the most important changes in the WMS-market annualy in an independent international study. This report summarizes the results of the German-speaking sector.

Werksplanung und Logistik IWL

THE SUPPLY CHAIN GROUP
www.the-scg.com
SCG

List of Abbreviations

ERP	-	Enterprise Resource Planning
IT	-	Information technology
MFP	-	material flow processor
PbV	-	Pick-by-Voice
PPC	-	Production Planning and Control
RFID	-	Radiofrequency Identification
SC	-	Supply-Chain
PLC	-	Programmable Logic Control
SQM	-	Software Quality Management
VoIP	-	Voice-over-IP
WMS	-	Warehouse-Management-System
WOLF	-	WMS Online Finder
MIS	-	Merchandise information system

Content: tables & graphs

References

expertOn Group
Logistics Simulation Ltd.
RFID@Metro
www.futurestore.org

The following 55 WMS-supplier have participated in our study “WMS-market 2007“:

Aberle Steuerungstechnik GmbH	aberle.PMS-L
Aldata Retail Solutions GmbH	G.O.L.D. Stock / Wacos
Astrosoft	Nereus
AT Automation Systems GmbH	ATCOLT
BSS Bohnenberg	bss
CAL Consult	CAL WMS
Centric Logistic Solutions	Locus WMS
Coglas GmbH	Coglas
Consafe Logistics	Effect Warehouse / Sattstore
CSB-SYSTEM	CSB-Inventory
Done Solutions	FidaWare
Dr. Thomas + Partner GmbH	TWS
e-Buzz	Easy Order® WMS
ECOLOG Logistiksysteme GmbH	CI_LOG
Exact Easy Access	Easy Logistics WMS
Four Soft	4S iLogistics / DCSi.Logistics TWS
Fujitsu Services	MLS
GIGATON GmbH EDV- und Netzwerkberatung	LogoS V 2.2 C/S
Hörmann Logistik GmbH	Hi LIS
IBS	DYNAMAN
IMI	IMI Warehouse
inconso AG	inconsoWMS
Interchain	Chainware iWarehousing
Inther Logistics Engineering	Inther LC
INTRIS	TRIS
ISA - Innovative System Solution for Automation	ISASTORE
Kardex	Powerpick 5000
LOG-IT GmbH	dilos

Lunzer + Partner GmbH	LOGSTAR
Manhattan Associates	MA WMS & iSeries / MA WMW
Oracle	Oracle WMS
proLogistik GmbH + Co KG	pL-Store
Qurius NC	Navision Q-WMS
Radio Beacon Inc.	RADIO BEACON WMS
Rasputin MagazijnbeheerProjecten	Rasputin
RedPrairie	DLx® Warehouse / MARC WMS
Salomon Automation GmbH	WAMAS
SALT Solutions GmbH	[s]-warehouse
SAP	SAP R/3 LES
Savoye a-SIS	LM Execution
Siemens	ProX4 WM
SSA Global	Exceed / Warehouse BOSS
STILL GmbH	MMS-X
Stöcklin Software AG	LAKOS
S&P Computersysteme GmbH	SuPCIS-L8
Supply Point Systems GmbH	SupplyPoint
swisslog	WarehouseManager
TEAM Partner für Technologie und angewandte Methoden der Informationsverarbeitung GmbH	ProStore®
TRANSFLOW	LBaseWMS
Unitechnik Cieplik & Poppek AG	UniWARE
Van Boxtel Software	VBS-WMS
Vanderlande Industries Logistics Software GmbH	VISION
viastore systems	viad@tWMS
WICS Solutions	WICS
XELOG AG	LagerSuite

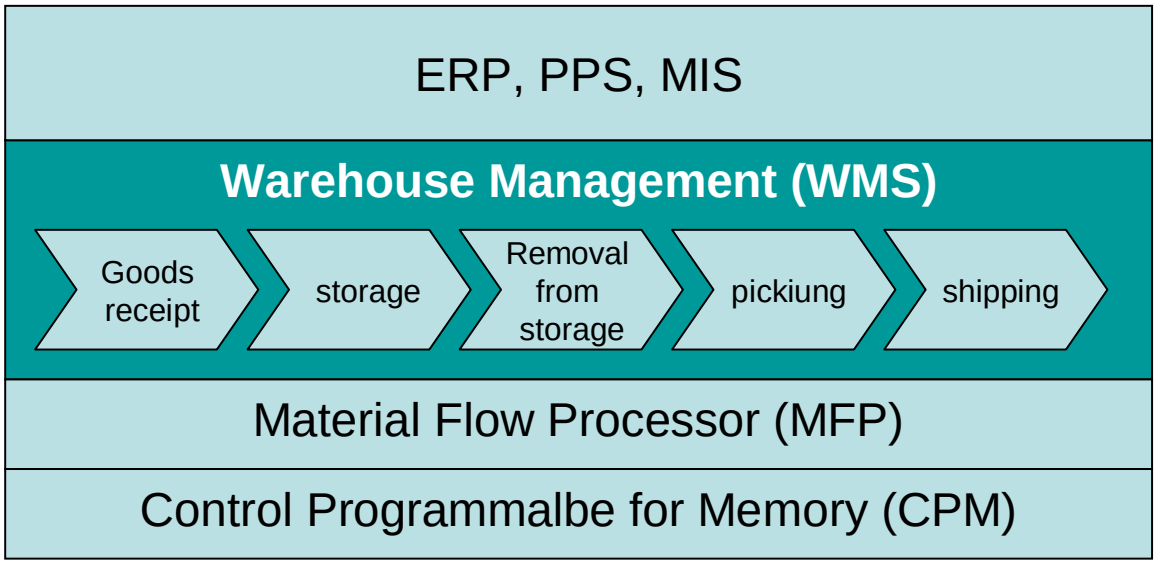
table 1: list of the participants

Current Market Development

Driven by the increasing globalisation during the last years we can observe definite developments in the economy, which demand for continuously increasing flexibility and speed. These developments have also influences on the logistics sector.
The increasing requirements here are:

- Reduction of the processing time
- Minimisation of the inventory
- Shorter order cycle
- Shrinking order quantity
- Faster assortment changes
- Flexible product spectra

These business trends directly affect the Warehouse Management Systems (WMS), which often reach their limits because of the demanding requirements. Especially those systems, which are 10 years old or more, cannot be adapted to the new requirements anymore - or just with plenty of time and effort. In many cases, a replacement of the system is the cheaper solution in contrast to extensively modernising the existing system. Often, a lot of other shortfalls are detected when several software systems, like WMS, ERP or PPS, are professionally checked. Those can only be fixed optimally by an overall restructuring of the company's IT-architecture. Many companies, however, shrink away from such a big move and risk thereby cost-intensive breakdowns of their warehouses and delivery. Graph 1 shows the classification of the WMS and its core functions in the IT-architecture.



graph 1: levels of the IT-architecture of a company

The interaction of different IT-systems and their interfaces are often highly complex and the demand for flexibility is increasingly high.
Thus the person in charge of a system replacement should especially make the following demands on the new software:

- standard system or. standard interface
- modularity
- scalability
- parameterising possibility

This is the only possibility today to guarantee investment security for the new IT-system.

WOLF: the WMS Online Finder

WMS-selection tool – online availabe – for free!

In collaboration with the SCG (SCG - The Supply Chain Group AG), the IWL AG investigates the WMS-market annually. In this report, we present a summary of the investigation results in the German-speaking sector. Detailed information about all participating WMS-suppliers can be found online at:

www.wmsfinder.com
www.iwl.de
www.the-scg.com

Our online-selection tool WOLF (WMS online finder) enables you to make a fast and free pre-selection of Warehouse Management Systems, which meet your requirements best. In the SCG WMS-Finder are listed more than 50 Warehouse Management Systems of European and North American suppliers. Within our survey they have evaluated their market position and target group with the help of a questionnaire.

suppliers	product		clients total	installations	new clients in the last year	new installation in the last year	*new clients 2004*	*new installations 2004*
inconso AG	inconsoWMS	++	230	270	20	30	*15*	*25*
STILL GmbH	MMS-X	+	165	250	15	40	*10*	*65*
ISA - Innovative System Solution for Automation	ISASTORE		130	180	15	15	*15*	*15*
Salomon Automation GmbH	WAMAS		146	234	11	14	*10*	*15*
viastore systems	viad@tWMS	-	150	300	10	10	*15*	*25*
ECOLOG Logistiksysteme GmbH	CI_LOG		140	140	10	10	*10*	*10*
Stöcklin Software AG	LAKOS		200	200	10	10		
Dr. Thomas + Partner GmbH	TWS		39	62	9	14		
proLogistik GmbH + Co KG	pL-Store	+	65	175	8	15	*5*	*15*
Coglas GmbH	Coglas		83	120	8	12		
LOG-IT GmbH	dilos	-	40	70	8	4	*9*	*10*
Hörmann Logistik GmbH	Hi LIS		52	61	7	7		
TEAM Partner für Technologie und angewandte Methoden der Informa-tionsverarbeitung GmbH	ProStore®		62	78	6	6	*6*	*6*
SALT Solutions GmbH	[s]-warehouse	-	45	32	6	3	5	*54*
XELOG AG	LagerSuite	+	68	102	4	13	5	6
Lunzer + Partner GmbH	LOGSTAR		80	100	4	10		
Unitechnik Cieplik & Poppek AG	UniWARE		36	59	4	6	4	6
Aberle Steuerungstechnik GmbH	aberle.PMS-L		10	12	4	4		
Supply Point Systems GmbH	SupplyPoint		20	17	4	3		
Aldata Retail Solutions GmbH	G.O.L.D. Stock/Wacos	-	15	42	3	3	4	11
GIGATON GmbH EDV- und Netz-werkberatung	LogoS V 2.2 C/S	-	30	75	2	4	5	5
Vanderlande Industries Logistics Software GmbH	VISION	-	35	39	2	2	4	2
AT Automation Systems GmbH	ATCOLT		5	5	1	1		
S&P Computersysteme GmbH	SuPCIS-L8						5	5
BSS Bohnenberg	bss							

Table 2: WMS-supplier according to the numbers of new customer in the German-speaking sector

The WMS-market 2006

In 2006 the WMS-market showed - as expected - a restraining, but continuous growth.

Generally, several criteria can be used to evaluate a market:

- turnover
- sales
- profit
- number of new suppliers
- number of new products

The number of new clients and new installations is a significant indicator for the evaluation of the development in the WMS-market. Table 2 shows the market distribution of last year for the German speaking sector. The supplier with the highest amount of new clients is the inconso AG, closely followed by Still and ISA.

Comparing the growth in 2006 with the previous year, one can assess that most of the companies grow relatively constantly. Only little companies like inconso, STILL, proLogistik and XELOG had an increased growth rate. According to experts' estimations the potential of the WMS-market is currently and in the coming years not fully tapped.

Actually business processes are not supported optimally anymore by many old systems. Nevertheless, many companies hesitate to substitute their old systems.

What are the reasons for this reservation? From our point of view, there are many different aspects, which influence the responsible persons within this context:

- There are other priorities in the company.
- The process works more or less satisfying. The persons in charge act according to the maxim „Never touch a running system!"
- They are afraid of difficulties in IT-projects, particularly in the core processes like the WMS.
- They hesitate because of uncertainties concerning the decision-making: There is no universal standard solution, but several possibilities with different advantages and disadvantages.

In this study, we want to discuss the reasons for the unassertive development of the WMS-market and reveal possible potentials.

IT-Priorities

A survey of the expertON Group showed that cost reduction, cost control and cost transparency together with the topic security – like in the previous years – are on the top of the agenda of the companies' IT responsibles. The following positions of the ranking are also dominated mainly by pure business-management topics.

Only two aspects of the IT-priorities' list are in direct context with WMS: the desire for RFID-integration and second the desire for an ERP-optimisation. In the evaluation of the survey, those two issues have been taken into consideration to estimate the future investment volume for the WMS installations. Since they show a relatively small priority, we estimate the propensity to invest of the market as comparatively reserved.

priorities	small scale enterprises	large scale enterprises
cost reduction, control, transparency	+++	++++
security	++++	+++
sourcing	++	+++
flexibility	+++	+++
standardization	+++	+++
consolidation	+++	+++
IT-Business-Alignment	+++	++
networking, internationalization	+++	++
RFID	++	++
ERP optimization	++	++
VoIP	+++	+++
management of documents	+++	+++

table 3: IT-priorities

The results of the survey shown in table 3 reveal that saving potentials regarding WMS have been partly identified and some yet implemented. The priorities, however, are ascertained in other sections. Therefore, a not much higher growth is to be expected in the upcoming years.
Our experience as independent logistics consultants is that the persons in charge of the companies often focus so much on the core competences of the company that the not-adding-value sector logistics is being neglected over years. The awareness of the risk that this can possibly lead to a costly and image-damaging standstill of the delivery, is missing in many cases and has to be raised by the WMS-suppliers in the upcoming years.

Success Factors in Sales

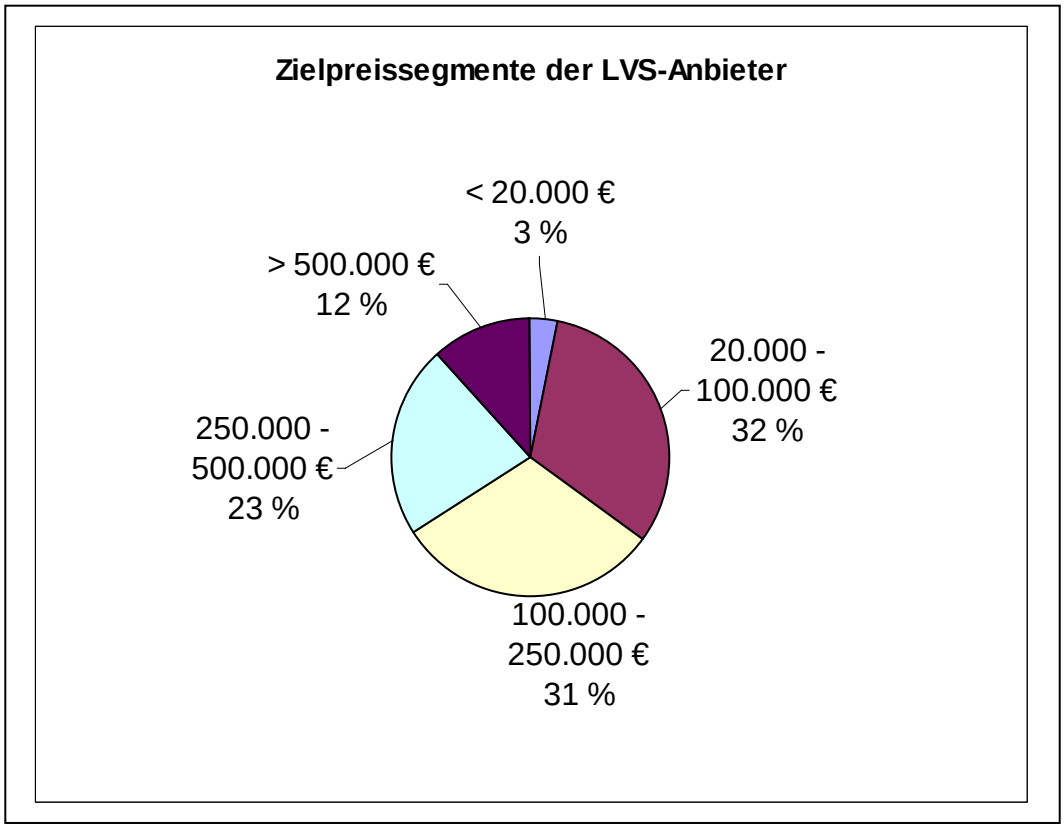
In the context of the survey, we have examined the arguments currently used by the WMS-suppliers in order to place themselves successfully in the market. The WMS-suppliers had the following aspects to select - multiple choice was possible:

- continuity of company and system
- high functionality
- partnership and service
- simple and fast implementation
- integration in ERP, modularity
- new technology concerning platform, data base, interface, frontend
- best price

	success factors	2005	2006	tendency
1	special functionality	17 %	21 %	+
2	integration, modular build-up	11 %	18 %	++
3	fast and simple implementation	15 %	16 %	+
4	partnership	16 %	14 %	-
5	continuity of supplier and system	20 %	13 %	--
6	newest technology	12 %	10 %	-
7	best price	10 %	8 %	-

table 4: sales arguments of the WMS-suppliers (multiple choice was possible)

Table 4 shows the weighting of the seven criteria in 2005 and 2006. The difference of the rating of the success factors which ranges from 8% to 21% is relatively small. At the very bottom of the ranking the criterion Price can be found. Price seems to be a rather subordinated unique selling point for the WMS-suppliers as it has been in the previous years. This might also be due to the fact that the researched WMS's are high-price products, which can also be identified in the distribution of the target price segment of the WMS-suppliers, presented in graph 1.



The participating suppliers target predominantly the middle- to high-price segment. Solutions with a project volume up to 20,000 Euro are not in the focus of interest of the surveyed WMS-suppliers and are only for very few of them a potential market segment at all.

Regarding the increasing market demand for standard solutions and the rather little interest of the WMS-suppliers in small projects, the question arises, if small standard solutions are a market niche.

Especially for small warehouses, small subsidiaries abroad etc., small companies are often looking in particular for a standard Warehouse Management System with low adjustment costs. With regard to the increasing fast pace of life today and the cumulatively higher flexibility requirements of the systems, people often shy at the high investments neccessary for new individual software. For lack of a universal, flexible, standard complete system, they rather search for a low-price, simple standard solution. This offers significant potential in the low-price segment, which is only deducible via the price level as well as in the higher-price segment: The universal standard solution is still not invented.

The broad functionality of the system, as well as a fast and simple implementation and integration are likewise important for the WMS-suppliers. In comparison to last year's estimations, the simple integration has remarkably increased in its quality rating. Therewith, the vendors make allowance for the increasing market demands for an integrated, complete standard solution.
On the other hand the continuity of the company and system, as well as partnership, have been ranked less important than last year.

Scope Of Supply– Tendencies Towards General Suppliers

	scope	distribution	interest
1.	WMS	59%	96%
2.	Pickup systems	23%	75%
3.	warehouse technique	9%	33%
4.	cooperation with sub-company	8%	42%

table 5: scope of the WMS-suppliers

Table 5 shows that many WMS-suppliers offer not only Warehouse Management Systems but also more and more warehouse technique, pickup-systems, etc., or cooperate with sub-contractors to be able to of-

fer a wider spectrum of products.

A further development, regarding the scope of supply, is the tendency towards integrated systems. That means, more and more ERP-systems are equiped with integrated WMS-modules, or WMS-suppliers exptend their WMS to integrated complete solutions with the help of additional modules. One reason for this development could be the decision-makers' fear of apparently incalculable risks with the interface connection and the subsequent desire for integrated Systems.

So far, the Best-of-Breed-Strategy was reckoned as the silver bullet of the IT. Thereby, the best software solution is searched for each section and then connected to the IT-architecture of the company via interfaces. On the one hand, this requires high coordination costs. On the other hand, the complete system becomes complex and in-transparent over time. Such systems grow with the persons that implement and administer them and can in the end quite frequently only be seen through and managed by those.

Currently, there are many companies in comparable situations. With bad experiences back in mind, and aware of the constantly increasing requirements of the market, many persons in charge ask themselves, if it is still cost-effective to implement a custom-made, but expensive Best-of-Breed-solution. It has to be taken into account that general conditions can change quickly - in these times quicker than ever before. Changes of the general set-up like that can lead to the situation that the custum-made WMS is not ideally tailored to the operation processes in the warehouse any more. Thus the question can be arisen if it is more sensible, to standardize the business processes instead and adjust them to a standardised general system. More and more companies decide lately in favour of the latter solution.

This conculsion sounds logical but it is not to be ignored that general systems are naturally never optimally applicable to any particular company. The company has now either the possibility to adjust its processes to the standard – as already mentioned – or to modify the general system costly to the operation processes of the company.

As a conculsion we can state that there are different solution alternatives, but no universal recommendation. The minority of the decision-makers view an opportunity within this. On the contrary: Many persons in charge are confused and delay necessary decisions.

For the WMS-suppliers, the current situation means, in the context of Best-of-Breed-Strategies, their systems have to provide several functionalities to be adjustable with as little effort as possible and to be easiely integratable into the company's IT, and therefore be successful in the long run:

- modularity
- scalability
- parameterization
- standard interfaces
- update- and release ability

Optimal Project results

Before the implementation of a new WMS it is extremely important to review and if necessary to optimise the current processes in the warehouse. A system can only be as good as its process, which it is based on. Badly structured processes do not improve with the implementation of a new IT system, quite the opposite: They reduce the performance of the new system. Regarding this, the companies benefit in any case from calling in external consultants for the WMS implementation. Those assess the situation objectively and can realize changes more efficiently than the own employees, since they are not ingrained in the social structure of the company.

Furthermore the consultants as external project management can absorb the substantial organisational effort, which is caused by the implementation and initiation of a new WMS. Frequently occurring problems can be counteracted right from the beginning, because competent logistics consultants have usually already completed several other WMS-projects successfully. With this experience, they support the responsible persons during the implementation and thus additionaly achieve an all-inclusive transfer of know-how to the particular company.

A method of resolution for the interface problems could be the use of middleware, which enables a comlete integrated workflow by business process orientated integration.

Here, we recommend to pay attention to standardised interfaces of the systems.

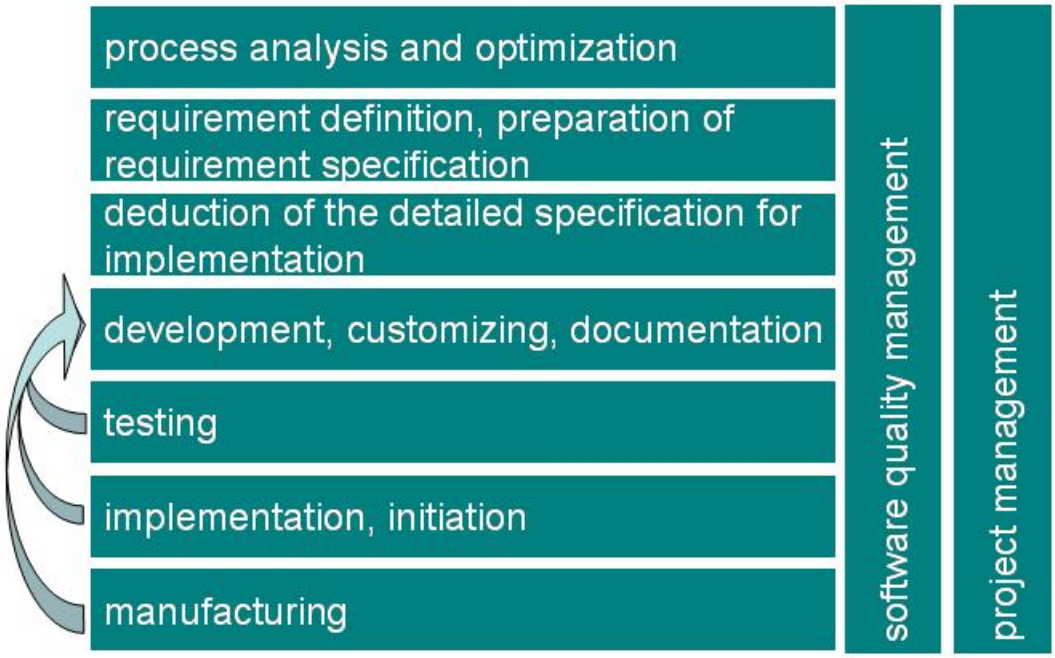
Difficulties With IT-Projects

Negative experiences with IT-projects in the past make many persons in charge hesitate and postpone necessary projects and their implementation as far as possible. As long as the existing system still works, they mostly do not deal seriously with the risks of the old system and with the optimisation potential of using new software.

But this concern is nowadays widely causeless, because negative experiences are preventable with the help of detailed planning and competent consultation.

The phases of a successful software project should be the following:

- process analysis and optimization
- requirement definition, preparation of the requirement specifications
- deduction of the detailed specification for implementation
- customising, developing, documentation
- tests:
    - code-testing
    - selected business-cases
    - certificated tester
    - pilots
- implementation, initiation
- maintenance



graph 2: process of a WMS-project

The WMS-suppliers have detected these reservation as problematic and try presently to clear them or to weaken them by implementing increasingly software quality management methods.

What is SQM?

The aim of the Software Quality Management (SQM) is to guarantee:

- that the software is according to the requirements and programmed error-free
- that the implementation and initiation is operated smoothly and timely.

In order to sustainably achieve those goals there exist several approaches:

- **Standardised processes**
  The standardisation of processes contains the universal definition and optimisation of work steps and operations, from the definition of requirement to maintenance. Consistent workflows are being achieved by optimisation and standardisation, which finally leads to securer processes. The optimisation and the agreement of standards, however, do not lead to operation improvement. The compliance of the standards simply facilitates easier and therefore securer processes, which are less error-prone. Consequently, the standardisation is

not a magic bullet, but the base for a good Software Quality Management.

- **Certification according to ISO 9001**
  With the ISO-9001-certification standards are defined, introduced and controlled in regular audits. The certification shall therefore conform that standardised processes are introduced and applied.

- **Certified tester**
  An important pre-stage of the initiation is the testing of the software. By extensive tests bugs can be detected in time before the initiation. The significance of the test can also be seen by the existence of certified tester. The International Software Testing Qualifications Board (ISTQB) provides a world-wide recognised Certified-Tester-Program, a standardised further education scheme for software tester. According to specifications of the ISTQB, more than 2,000 certified tester existed in Germany in 2005 already and more than 20,000 worldwide.

- **SQM-Software**
  The Software Quality Management can also be supported by software tools. Here are available, for instance:
  - Software for automated testing of source code.
  - Bug and Issue Tracking (e.g. Bugzilla)
  - Software to support structured coding (e.g. Easycode)
  - Software to support documentation.

Basically, it is important to profoundly document and optimise the business processes, which have to be supported by the WMS, and other WMS requirements before the beginning of the development or the customising. From the requirements, described in the specification, the WMS requirements are then to be derived in detail and documented as precisely as possible in the detailed specification for implementation. In this critical phase or during the whole project as well, more and more companies work together with external consultants. They are well experienced in the realisation of such projects, expose faster inefficient processes, since they are ‘outsiders’, and know where the critical issues are located. Beside a good quality management, the significance of the project management for the success of the project is also not to be underestimated. In addition to the daily business, this workload is often not manageable by the own employees.

	software quality management	distribution	interest
1.	standardized processes	46%	79%
2.	SQM Software	8%	29%
3.	ISO 9001 certification	40%	63%
4.	certified tester	6%	25%

table 6: characteristics of the Software Quality Management

SQM In Practice

More than 60% of the suppliers are already ISO-9001-certified and also the non-certified claim to have at least an interest in the implementation of standardised processes. The use of certified testers and SQM-Software, however, is currently not so far spread, but will certainly in future be pushed. It is striking that within the SQM, especially the development and testing process is being monitored through adequate measures. Standards and supportive tools are often used in this area.

The integration of the clients into the quality management instead only takes place partly and neither from all suppliers, according to the survey results. Consequently, it is hardly possible for the client to verify the software quality before the initiation. The following measures to integrate the client have been named by some WMS-suppliers.

1. Active participation

- Participation in tests
- Taking part in developing the specifications – e.g. in workshops
- Definition of test cases

2. Passive participation

- Review of documents, like e.g. test documentation
- Access to problem database

The participation in tests and the definition of specifications has been mostly referred to in this context. The monitoring of the development is difficult and almost impossible for the client. According to the British consultancy Logistics Simulation Ltd. (LSL), there are especially in this field, enormous optimisation potentials. By detailed analysing of PLC-Logs in one of their projects consultants of LSL have discovered errors in the control of an automated warehouse that could be traced back to programming bugs in the WMS. The warehouse performance has been increased by 20% after their clearance.

According to specifications of Mike Willson (logistics Simulation Ltd),

similar potentials can be found in many Warehouse Management Systems, however, the subsequent search is exceedingly exhausting. Therefore, it is even more important to insist on established expert advice during the definition of the WMS requirements and its development, in order to avoid errors from scratch.

Trend of Development

In this survey, the WMS-vendors have been asked to name their most important developments of the previous years and the near future. In table 7, the tendencies of development are listed according to the stated priorities.

future priorities	priority of the last years	tendency	tendencies of development
1	**1**		**Internet**
2	8	++	technology
3	9	++	ability to integrate, interfaces
4	4		user interfaces, handling
5	6		RFID
6	12	++	system integration
7	2	-	planning and monitoring of capacity
8	3	-	additional warehouse functionality
9	5	-	management information
10	7	-	voice recognition
11	10		Supply-Chain functionalities
12	14	+	test and Software Qualitäty Management
13	16		transportation planning
14	17		3PL
-	11		billing
-	15		tracking and tracing
-	18		yard- and dockmanagement
-	19		RF-scanning

table 7: Trends of development in near past and future

The biggest trend during the last years and obviously also for the future are internet developments which still reign supreme. In this context the further development of the user interface to the point of web-based user interface is also to be mentioned. Almost all of the respondent WMS-suppliers are currently occupied with adjusting their WMS to these requirements.

However, it is interesting that the development trends are not yet reflected in the suppliers' target definitions, which define the kind of projects they prioritize. Table 8 shows for example that concerning the user interface, the WMS-suppliers are still mainly focused on a graphical user interface. Apparently are the developments in this area not yet finished. But 88% of the suppliers are already explicitly interested in realising web-based systems. It can be assumed that the web-trend will establish within the next years.

It is remarkably that developments of functionalities like capacity planning or management information, have become less important and technological factors, like new interfaces and technologies as well as system integration, have gained in importance. It is to assume that this new spreading of priorities can be amongst others traced back to the fact that these special functions are already implemented in many WMS. Moreover, those strategies are a response to the market requirements.

RFID is a further functionality that is often still listed as a development trend, just like Pick-by-Voice. Table 9 shows, on the other hand, that the WMS vendors' focused projects are, concerning the communication support, still fixed on RF-Barcode-Technology – and not on RFID or Pick-by-Voice, like it could be assumed regarding the development tendencies. This also demonstrates that these application trends have not yet become widely accepted.

	user interface	2005	2006	interest 2006
1.	graphic user interface	54%	56%	100%
2.	web-based user interface	33%	38%	88%
3.	signal-based interface	13%	7%	33%

table 8: developments of the WMS user interface

	communication support of the target group	2004	2005	2006
1.	RF barcode	44 %	42 %	43 %
2.	Pick-to-Light	14 %	15 %	19 %
3.	Pick-by-Voice	13 %	13 %	14 %
4.	paper lists	16 %	16 %	12 %
5.	RFID	13 %	14 %	12 %

table 9: distribution of the communication interfaces

Developments in the field of RFID

Radiofrequency Identification – short RFID – allows it to transfer data contact-free via radio. For years already, RFID resounded throughout the country with the highest expectations. Almost all interviewed WMS-suppliers have already integrated RFID-standard interfaces in their systems or have set themselves the target to do so in the following years (compare table 7). But how many implementations really exist already? And for whom is RFID of interest at the moment?

Due to remained high prices for high-quality RFID-transponder, the use of this technology pays mainly off for high-price items. In the meantime, there are indeed also lower-priced tags on the market, those however are also noticeably inferior in quality. Even small metal parts in the product packing or in their surroundings can already strongly influence the reading reliability of the RFID-scanner. Before implementing RFID, extensive testing with the tags and the used totes on site are necessary in order to avoid unprofitable investment.

One of the most familiar RFID-projects is the application at the Metro Group. In the end of 2004, RFID has been implemented there strategically – with the objective of optimising the processes of the complete supply chain. Two years later, this objective is still not achieved. So, e.g. the complete recording of a basket of goods – one of the main goals of Metro's future stores – is theoretically possible, practically however it willjust operate reliably, if all items are neatly packed in the shopping cart, since the tags are to be aligned vertically to the scanner.

Furthermore, the Metro Group still sticks to its plans and demands from their suppliers to ticket their goods with RFID-tags. According to a study of Metro, IBM and Procter & Gamble, the simple and secure processes, which can be achived with RFID, lead to savings of millions of Euros. For the suppliers, however, no advantages are given as long as they do not use the RFID-technology themselves. Moreover, the additional ticketing with RFID-tags is a costly, additional effort for the supplier.

In the beginning of the planning phase, the RFID is taken into consideration for most of the WMS-projects. But after further examination, this option is often abandoned again, because the advantages do not carry the costs yet. This, of course, is due to the fact that the universal usage of RFID-transponder throughout the complete supply chain is mostly not evaluated or included in the considerations. As a simple substitute for a barcode label, this technology is currently still too costly.

When and why could RFID be established anyhow? Requirements of the commerce, like those of the Metro Group, could lead to the fact that transponder and RFID-scanner are also dictated to the lower supply chain links in the next years and then used, since available. Similarly, increasing quality and legal requirements, like batch tracing or documentation of temperature control, can facilitate the implementation. However, the experience shows that this development should not be overestimated. Further on, the process will continue only gradually.

Advantages of RFID:
- Contact-less data transfer
- Fast and simple recording of various information simultaneously.
- Complete information chain throughout the whole supply chain by information storage directly on the product.

Disadvantages of RFID:
- Expensive tags
- Expensive, optimisable technique
- Optimum readability currently only under special circumstances
- Readability can be negatively influenced by the surrounding.

Also interesting regarding RFID, is the foreign usage of this technology. So, STILL has, for instance, realised a position monitoring system for freely navigating lift trucks with scanner and RFID-transponder, which are distributed in the warehouse. For this reason, the tracking and tracing can completely be guaranteed in this warehouse.

Developments of Pick-by-Voice

Besides RFID, the Pick-by-Voice-picking is also a intensively discussed issue. Most of the interviewed WMS-suppliers have already integrated standard modules for the connection of voice-devices in their systems or will do so within a short time (compare table 7).
Pick-by-Voice is suitable for applications with the following characteristics:

- Extensive picking areas for which other control technologies, like Pick-by-Light, are too complex.
- Many commissioner, who work parallel in one area
- Large products, which have to be handled with bi-manual
- Processing with commissioner handicap, as for instance gloves in the cooling area.

The number of realised PbV-applications is still limited and the realisation holds its perfidies. So, the voice recognition programs are not

yet error-free and can influence the initiation phase remarkably.

To keep the picking process as simple as possible, the dialogues have to be reduced to the necessary minimum. Right in the initiation phase, this can lead to the fact that the user cannot assign errors by reduced error dialogues, like “Please repeat the order!” After a mostly complex and time-consuming initiation phase, the PbV-application is normally being well accepted by the commissioner.

The trouble, however, that each commissioner has to be introduced to the system, remains. And this includes not just the explanation and understanding of the application, like with other picking methods, but additionally a voice recognition training for the software, which lasts noticeably longer. A spontaneous exchange through support staff is therefore not possible because of the voice fixation.

Especially in ample picking areas, multi-picking is sensible. Concerning PbV, it has to be kept in mind that the error-proneness and error control, simply through Pick-by-Voice-support, is more difficult without Put-to-Light, for instance. The dialogues for the position identification, removal request and confirmation, require more time compared to guiding through hand-held terminals or even Pick-by-Light, also without faulty input and correction.

Pick-by-Voice has definitely its authorisation, but it is not a substitute for Pick-by-Light and not suitable for every implementation.

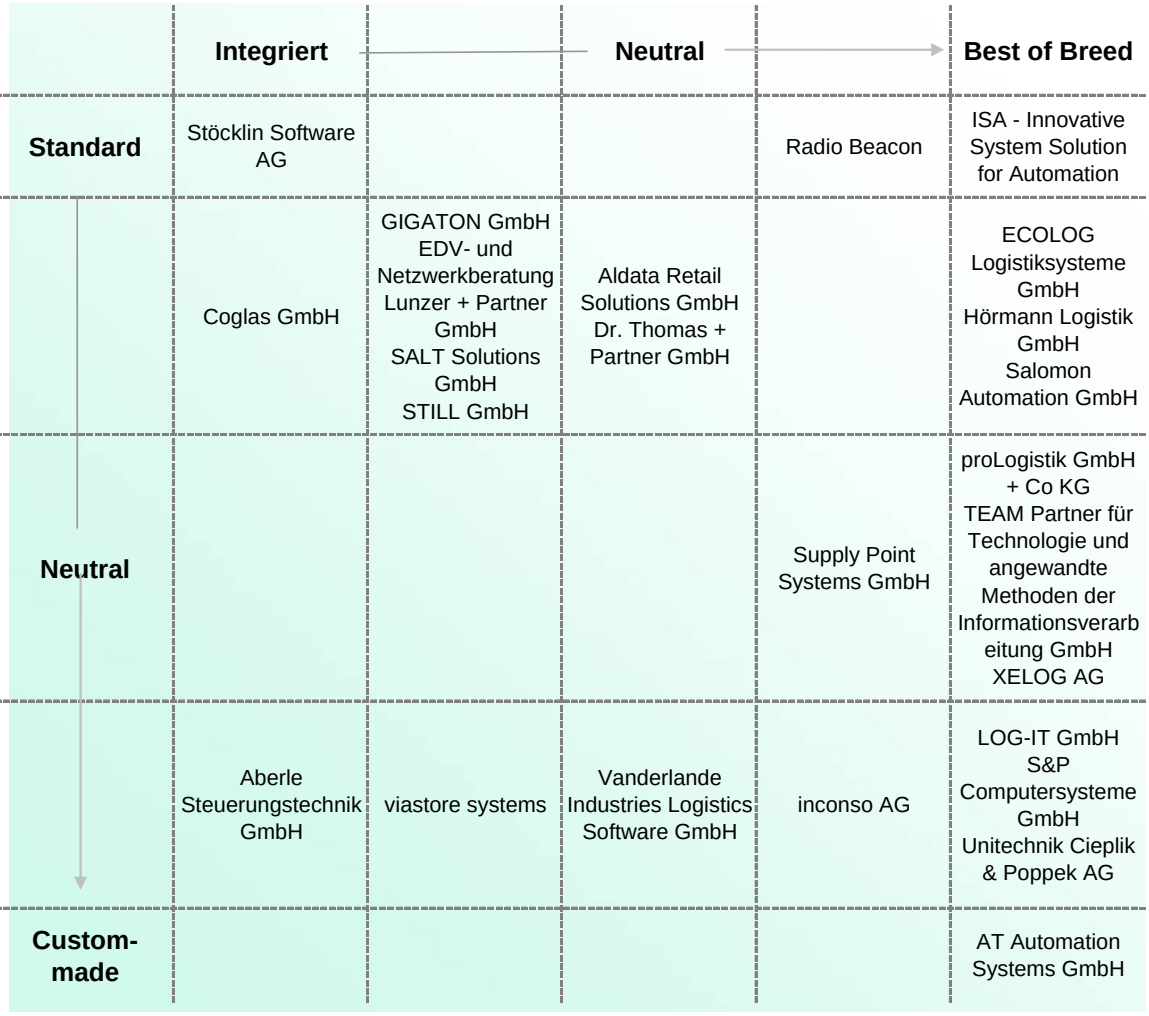
System Architecture

As already mentioned, the results of the study prove that the trend towards the integrated standard system continues further. Table 10 shows the tendencies from 2004 until today.

	configuration	2004	2005	2006
1.	standard systems	50 %	60 %	59 %
2.	custom-made	50 %	40 %	41 %
	structure	**2004**	**2005**	**2006**
1.	integrated system	23 %	32 %	38 %
2.	Best-of-Breed	77 %	68 %	63 %

.

table 10: System architecture



graph 3: integration and standardization portfolio of the WMS-suppliers

If placing the participating suppliers into a matrix, the picture in graph 3 results. The trend continues for years from the custom-made ideal solution to the standard software and – even if a little more reserved – away from the Best of Breed to integrated systems. This development can be traced back to the market requirements for standards and integration and will also continue during the next years.

Summary

- The technological developements of the Warehouse Management Systems towards Internet and web-based user interfaces are in the focus of many WMS-suppliers.
- In order to design sustainable WMS's, it is necessary to set high value on standards, scalability and modularity.
- RFID is still a topic of interest. The all-inclusive, universal use still depends on the technological maturity of the RFID-products and will not yet be carried out during the next years. Within a WMS, this option should not be missing.
- Pick-by-Voice is a similar highly-praised technology like RFID. The actual appropriateness of this picking device, however, should be checked thoroughly and the causes of risk during the implementation should not be underestimated.
- Many of the older WMS are currently reaching their limits with the increasing requirements. This presents a huge potential for WMS-suppliers. However, the decisiveness of the persons in charge is restrained. Other IT-topics have higher priority.
- Interested persons are still critical to major WMS projects. The reasons therefore can be found in the uncertainty of the choice of system, but also in negative experiences in the past.
- The use of external consultants in the starting phase or during the whole IT-project pays off for the company, since e.g. lacks of requirement definition and other frequent errors can be avoided because of the project experience of the consultant.

Company contact

Werksplanung und Logistik IWL

IWL AG
Michael Muhsal
Mühlsteige 4
D-89075 Ulm
Germany
T +49.731.14050.13
F +49.731.14050.50
M michael.muhsal@iwl.de

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For further information please contact us:

IWL AG
Michael Muhsal
Mühlsteige 4
89075 Ulm
Germany
M michael.muhsal@iwl.de
T +49.731.14050.13
F +49.731.14050.50

www.iwl.de
www.the-scg.com
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