Reporting and Analysis (Business Intelligence) Needs and Tools Study

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Contributors: PG IT organization members, PG report owners

Audience: This study is intended for information technology and business-line executives who wish to understand challenges implementing organization-wide business intelligence strategy within Paroc Group

Content

Scope of this Study

Based on Paroc ERP global goals there was a clear need to do global summary of existing Paroc Group Reporting and Analysis (Business Intelligence – BI) needs versus existing in Paroc Group tools, solutions, experience and IT resources.

Tasks of the Study were defined by Paroc Group CIO in November, 2004:

Reporting and analysis needs and tools study

Description	**Definition, categorization and prioritization of the Paroc Group ERP related reporting and business analysis needs, assessment of available tools and a proposal to map reports and tools together and organize implementation during spring 2005; needs of the pilot implementation in Finland must be prioritized in accordance with the project master plan.**	
Person responsible	Gediminas Mickevicius	
Other resources	A team of four to five people named by Gediminas; Arja Konttinen as a coordinator with regard to the work of the printout team	
Schedule	Study must be ready by the end of December 2004	
Budget	None	
Core tasks	1	Needs assessment Which reporting and business analysis needs exist by process and by country
	2	Needs categorization Operative reports and printouts (to be coordinated with Arja) Recurrent calculations with possible ERP data updates Analysis reports and queries
	3	Tools evaluation and mapping Which of available tools are to be used for each report category and report • Basic IFS standard reports as such or with Paroc layout • IFS Report Designer (only layout modifications) • IFS Quick Report • Crystal Reports and a separate reporting database (need of a data pump?) • PIW converted to the new ERP environment as such or extended
	4	Report development organization A proposal to organize report development a) during the pilot implementation phase and b) for rollout phases and production use
Complementary tasks	1	Assessment of the role of the current Oracle based business intelligence and reporting solution in Sweden and a proposal of what of it to keep and what to rewrite with above mentioned tools.
	2	A long term data warehouse roadmap and implementation plan from 3Q2005 onwards can be proposed including ERP interface, DW database, OLAP tools, reporting tools and report publishing tools.
Restrictions	No new tools are to be introduced and thus no vendor and solution presentations or proposals are needed. A full scale data warehouse solution – apart from upgrading the existing PIW – can be implemented during the ERP pilot phase by May 2005.	

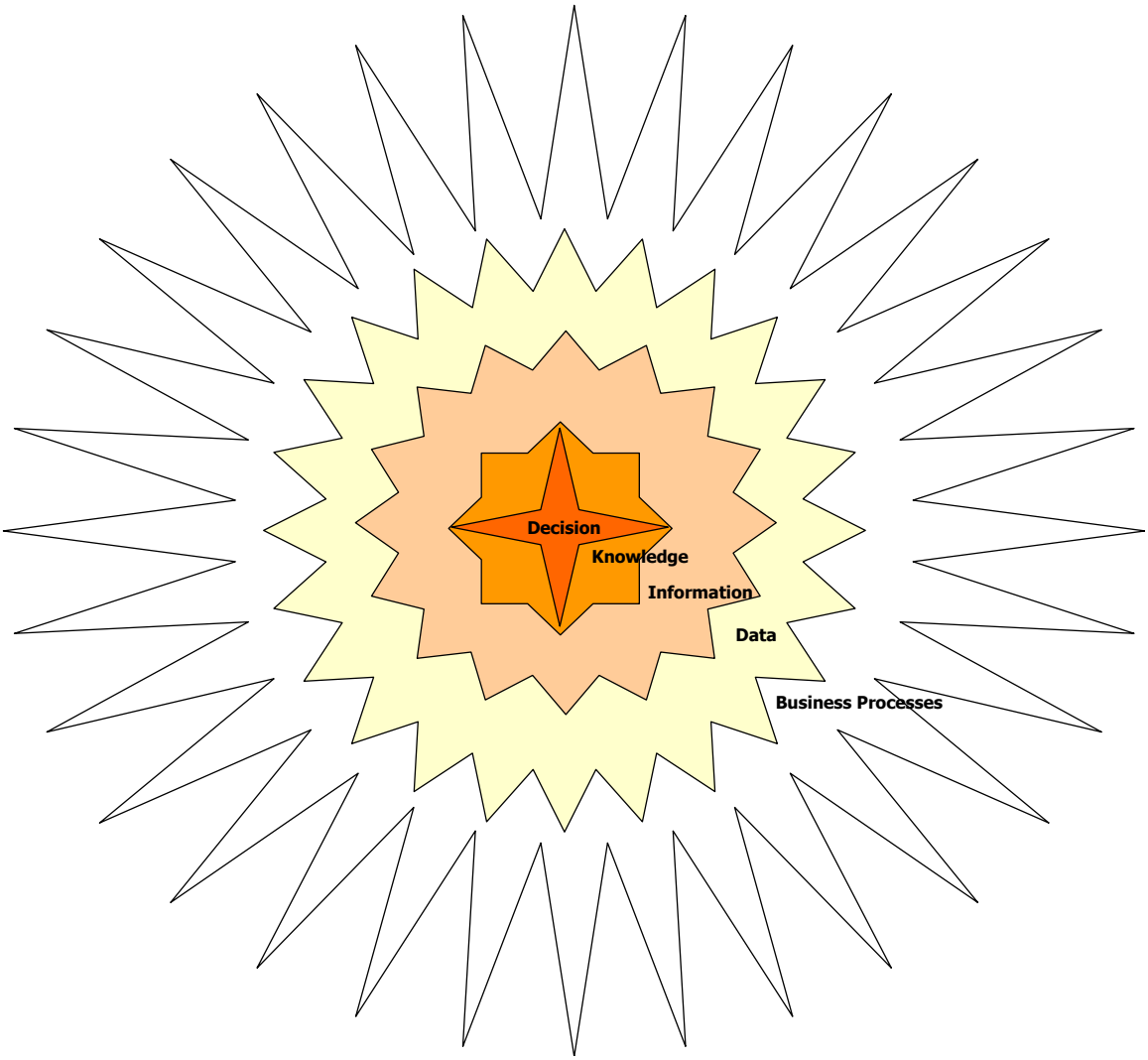
Executive Summary

Benefits

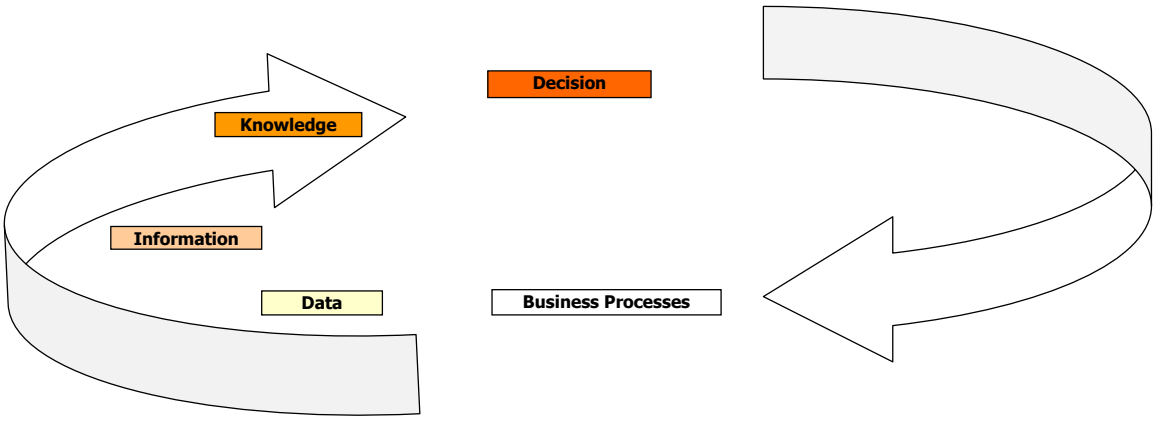
BI enables effectively monitor, understand and manage business processes by use of technology. An ideal BI system gives an organization's employees, partners, and suppliers easy access to the information they need to effectively do their job, and the ability to analyze and easy share this information with others.

In today's competitive markets, BI helps to reduce operational costs and also may be a key factor in improving revenue growths and service level. Enterprise BI is fast becoming a strategic differentiator for leading organizations. According to Keith Gile of Giga, "BI has evolved during the past three years from a niche, departmentally focused solution to a strategic enterprise asset."

Decision is a critical point of business management. Informative decisions are the result of BI implementation. Here is my "copyright" picture illustrating tiers of business intelligence:



And here is a picture of how it looks in action. It is a dynamic wheel – data transformed to the knowledge enables **informed decisions**. It affects business environment and business processes, closing the loop of business change. As someone noticed right - there are two types of companies – fast and dead. BI solutions are the "eyes" of company organism. It enables company be fast and smart.



According to a 2002 International Data Corporation Study, the average return on a BI investment was greater than 430%. Since BI project rely heavily on underlying data infrastructure, it's clear that much of this value comes from previous ERP architecture investments. Though BI is rather post-project than sub-project of ERP, its ROI should be calculate as one. Here comes some astonishing statistics of ERP projects ROI. According to a 1999 survey of large multinational companies, organizations took an average of 23 months to implement an ERP system (such as SAP or Oracle Applications). And over a five-to-six-year period, the average company incurred a net return on investment of *negative* $1.5 million.

Summarizing this paragraph, it is obvious that BI leverages existing data assets. In theory and practice - one brilliant decision driven by insight of BI, can instantly justify all investments.

Funding

Nowadays BI is on the wave – a lot of consultants offering their solutions starting from several thousands to several millions euros or dollars. BI vendors also trying to persuade enterprise to acquire software packages ending with 6 zeros. Of course the bigger purchase the bigger discount, this is a tricky example:

$4,000,000 list software cost
$3,000,000 discount !!!
$1,000,000 actual cost of software

$800,000 annual maintenance on list price

Then software cost are only part from all budget, here are the rest:

- The cost of any hardware required (new server, PC upgrades, etc.)
- The cost to train the IT staff and end users (including deployment costs)
- Support costs for IT and any ancillary costs
- Traveling, face-to-face meeting, video-conferencing etc.

In my deep convincement very advanced tools are not main factor of success. If only small part from various astonishing features has practical use, tool may have same value as Concorde to Vatican. According Good to Great – technologies can accelerate but can not be fundamental reason of making company leap to great. Right people are the real assets of company. Therefore more important is invest to people who will carry-out BI development. It applies to both BI competence centre – BICC and BI Research and Development – BIRD (name I'd like to offer to IT team developing BI solutions, hope it will fly high)

What could be Paroc annual BI budget ? Hard to say yet - depends on what BI platform we chose and how high BI skyscrapers we are going to build. It will greatly depend on what is BI role in Paroc strategy. Weight and therefore funding of BI may be in similar range to ERP funding. If Paroc will have many data sources, large CRM, PDM, SCM systems and will aim to build large Data Warehouse with sophisticated B2B features, funding needs may be enormous.

In Lithuania OLAP solutions didn't took any funding – no new licenses, no extra server, no external consultancy, user training or outsourced developing. The only costs were my 5-day courses "Designing and Implementing OLAP Solutions with Microsoft SQL Server 2000", some extra literature and of course my time.

Microsoft is preferred platform in Lithuania. UAB Paroc organization structure and its data sets are quite compact. That's the main reason of so low costs and excellent cost/benefit ratio. Unfortunately it can not be simply copied as Paroc Group BI development scenario, but its experience definitely is very valuable.

Lithuanian experience

Building of Lithuania OLAP solutions was a very good experience. Nobody asked to do this, it was IT initiative to bring more value to business from existing data assets. In the beginning I was not sure if it is really needed, not everybody understood why IT is digging in their business. There was some natural human fear from some business people, that now they are transparent to IT and possibly to anybody in the company. It is a dual feeling – on one hand some people complain that there is too much manual reporting work, on other hand they are afraid that automated solutions can replace it, or make it more accurately and professionally. So, not all people wants too much and too good BI tools, but generally they admit that it is needed.

Fortunately to everybody, demand of new reports grows in balance with growing reports/information "supply" from BI tools. It is similar to paradigm of proportional balance between amount computers and papers ! Or like speed/capacity of data telecommunication and number of e-mail messages in your Outlook ! I will come to that problem later, but there is a fundamental axiom - the more developed BI - the more reports and the more time needed to follow them. Also it requires more IT time and resources to maintain and administrate it. BI is very time consuming activity and unfortunately information is not 100% accurate and reliable in every case.

That's why sometimes I'm giving philosophical question to myself, why we are doing this ? Well, I will not deny that I need some development activities and I like create nice tools for nice people. And the answer to me, why it is needed, is knowing that today OLAP solutions are recognized and appreciated by business, especially sales people, even though there are still a lot of things to create and improve.

Risk analysis

It quite risky to set milestones of BI development until we don't know how ERP project will end, and what data in what shape will be available. Undoubtedly, common Paroc Group ERP is a great opportunity and challenge to build solid PG-wide BI solutions. But in world practice, both – ERP and BI projects has more than 50% statistical probability to fail. Failure not necessarily means absolute failure – it may be fact that project demanded more funding or time to implement than planned, or that it didn't bring expected benefits.

There are many reasons why these projects have so poor records. Main reason is of course magnitude of work amount and its complexity. It also requires good team work and effective interaction between IT and Business Process Knowledge. Usually there is inevitable gap of communication interface. Therefore, there must be business champions on the board.

In my opinion, neither ERP, nor BI can be successfully implemented by outsourced company. It requires very deep and intimate knowledge about business processes and business organization.

Root reason of many problems maybe low company interest in BI and general low maturity and informative culture. In this scenario, companies are narrowly focused on solving problems and don't fully understand how information access could improve their business. The IT staff thinks of BI only as a technical infrastructure, while executives give too little attention to the strategic importance of BI.

Opposite reason of why it often fails – is gigantic scope of project. I will draw model of long term BI skyscraper in the last chapter of the study, but one important sentence of wisdom we should keep in mind before jump into "rocket science". Here it is - **Start from small ! Keep it simple !**

In BI, very often project scope intends to build "mother of all warehouses" or "super-hyper-cubes". Then it becomes to a "construction of the decade", eating more and more funds and resources. Instead of that, quick hits like simple country sales cubes, could be those blocks towards global enterprise BI pyramid. It also allows business people understand better their needs and by many iterations great results are achieved.

Politics may be a serious obstacle too. Some members of organization might not support BI vision, because it conflict with their group's agendas, requires resources from their groups or they feel the vision somehow threatens them. I strongly believe that this won't be obstacle for Paroc, because BI solutions would drive the values defined in Paroc Vision:

- Customer and market oriented
- Performance oriented
- Open communication
- Fast reactions and decisiveness

Core Task No 1 - Needs Assessment

Which reporting and business analysis needs exist by process and by country ?

Needs assessment is definitely the heaviest task from study scope. There are hundreds of report users, hundreds of different needs scattered across different business functions, processes, departments and divisions. In addition to that there are dozen of legal companies, countries and languages. Overall number of reports used locally and circulating across Paroc Group organization exceeds 1000, perhaps 2000.

Almost every employee uses some currently available ERP-standard or developed by internal BI resources or made by himself in Excel reports. Some are commonly used, some more individually. An average employee interacts with several reports, therefore I do estimation that there are more reports than employees in Paroc Group.

Magnitude of reporting needs equals to magnitude of ERP needs. ERP and BI is a "nice couple". BI is impossible without data accumulated in ERP. And nowadays, ERP value without solid BI solutions on top of it, is nothing but unrealized potential.

To understand complexity of reporting activities, let's try to analyze PG organization matrix. You may clearly see at least 4 dimensions there:

- **Function**
- **Division**
- **Country - Site.**
- **Legal Company**

Which of them is No1, most important one? Hard to say, question is rather philosophical, depends on point of view… Legal Company is perhaps most tangible entity, while Division is more virtual, but anyway very important nowadays. Here are table with PG organization dimensions and its members:

Division	Company	Country	Function
Base	Paroc FI	Finland	Purchasing
BI	Paroc SE	Sweden	Manufacturing
TI	Paroc PL	Poland	Maintenance
PPS	Paroc PL_TR	Lithuania	Logistic
	Paroc LT	Latvia	Sales
	Paroc_LV	Estonia	Marketing
	Paroc EE	Ukraine	Finance
	Paroc RU	Belarus	Controllers
	Paroc NO	Russia	IT
	Paroc DK	Norway	HR
	Paroc DE	Denmark	Others
		Germany	

To simplify further analysis lets assume that Company and Country is the same "thing", but before it please consider differences. Please see map of those 2 dimension intersection:

	Finland	Sweden	Poland	Lithuania	Ukraine	Belarus	Latvia	Estonia	Russia	Norway	Denmark	Germany	UK
Paroc FI	x												
Paroc SE		x								x	x		
Paroc PL			x										
Paroc TR			x										
Paroc LT				x	x	x							
Paroc LV							x						
Paroc EE								x					
Paroc RU									x				
Paroc NO										x			
Paroc DK											x		
Paroc DE												x	
Paroc UK													x

"Discovering" is that in Poland there 2 companies – Paroc Trzemeszno and Paroc Polska , basically one is producing, another selling. While Paroc sales offices in Belarus and Ukraine are legal subsidiaries (representative offices) of UAB Paroc, Lithuania. Similar reorganization is going to happen with Norway and Denmark offices.

Paroc Group	Paroc FI	Finland
	Paroc SE	Sweden
	Paroc PL	Poland
	Paroc TR	
	Paroc LT	Lithuania
		Ukraine
		Belarus
	Paroc LV	Latvia
	Paroc EE	Estonia
	Paroc RU	Russia
	Paroc NO	Norway
	Paroc DK	Denmark
	Paroc DE	Germany
	Paroc UK	UK

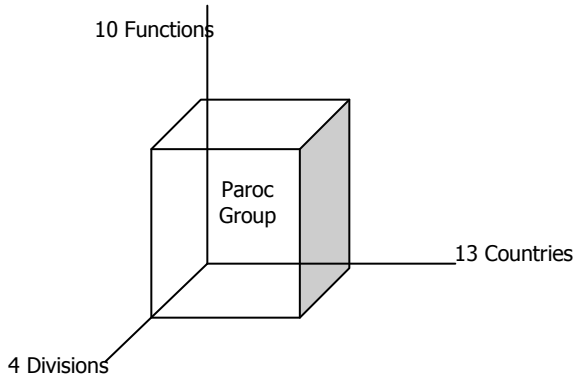
On top of those 12 there is 13th legal company - Paroc Group Oy Ab - Mother Company of all Paroc local companies. It could be pictured as second Finnish company, but perhaps better would be picture it as Total constituted of all 12 daughter companies.

Country dimension is nothing but geographical location. Therefore it would be best place to put all Sites of Paroc activity:

Production	Finland	PA
		LA
		OU
	Sweden	HH
		HK
	Poland	TR
	Lithuania	LT
Sales	Ukraine	UA
	Belarus	BY
	Latvia	LV
	Estonia	TL
		TT
	Russia	MW
		PT
		KL
	Norway	NO
	Denmark	DK
	Germany	DE
	UK	UK

Searching PG Intra I've checked official organizational structures of Paroc. Seems that Russia and Estonia are the only sales countries, having officially appointed persons to be responsible for different geographical districts. Moscow and S.Peterburg are sales offices. Point to distinguish Kaliningrad district from Russia, is only to identify it as market area of Paroc Lithuania sales. In Kaliningrad there is no representative office.

Ok let's think that there are 3 dimensions – Country, Function and Division. How many departments are situated by its intersections ? 13 countries x 10 functions x 4 divisions = 520 departments !



Well, that's not exactly so – not all intersections are valid - only some 1/3. Roughly in Paroc there are about 180 virtual departments. Those should be looked as smallest organizational element, possibly having unique reporting/analysis needs. From those elements reporting information can be consolidated to Country, Function, Division or PG total Business Intelligence needs. Building PG BI solutions is very important to understand this.

Sometimes it may be hard to understand organizational matrix, but would be very good if every employ and activity would have clear logical mapping within those 3 dimensions. It is very easy overlook some needs, because not all needs has official owner. E.g. TI Purchasing needs. Officially Purchasing function is under Base Production. Officially TI has Production but has no Purchasing. But of course TI has remarkable purchasing reporting needs.

Many of Sales companies don't have official Purchasing, Logistics, HR and IT functions. But they do have those activities. Then it is easy to miss some, or do incomplete assessment of Paroc Group reporting needs.

It may look too academic approach to track missing intersection of organizational matrix, but once again it is needed for constructing PG BI solutions. PG reports are made of those 180 departmental reports, missing or duplicated elements makes PG consolidation incorrect.

There is an organizational matrix **Division by Country:**

	Finland	Sweden	Poland	Lithuania	Ukraine	Belarus	Latvia	Estonia	Russia	Norway	Denmark	Germany	UK
Base	x	x	x	x									
BI	x	x	x	x	x	X	X	x	x	x	x		
TI	x	x	x	x	x	X	X	x	x	x	x		
PPS	x	x	x	x	x			x	x	x	x	x	x

Organizational matrix **Division by Function:**

	Purch.	Prod.	Maint.	Logistic	Sales	Marketing	Finance	Controllers	IT	HR
Base	x	x	x	x			x	x	x	
BI				x	x	x	x	x	x	
TI		x	x	x	x	x	x	x	x	
PPS	x	x	x	x	x	x	x	x	x	

Organizational matrix **Country by Function:**

	Purch.	Prod.	Maint.	Logistic	Sales	Marketing	Finance	Controllers	IT	HR
Finland	x	x	x	x	x	x	x	x	x	x
Sweden	x	x	x	x	x	x	x	x	x	x
Poland	x	x	x	x	x	x	x	x	x	x
Lithuania	x	x	x	x	x	x	x	x	x	x
Latvia				x	x	x	x	x		
Estonia				x	x	x	x	x		
Russia				x	x	x	x	x		
Ukraine					x	x	x			
Belarus					x	x	x			
Norway					x	x	x	x		
Denmark					x	x	x	x		
Germany					x	x	x	x		
UK	x	x	x	x	x	x	x			

Well, those matrixes are quite boring and not very informative. To have a more informative picture I've tried to model how those anticipated 1500 reporting needs resides across PG organizational dimensions. Here it goes:

Sum of Reports	Country												
Function	Finland	Sweden	Poland	Lithuania	UK	Russia	Latvia	Estonia	Germany	Denmark	Norway	Ukraine	Byelorus	Total
Finance	90	63	39	32	27	14	14	14	14	14	14	7	7	349
Sales	60	43	29	24	26	12	12	12	12	12	12	7	7	268
Controllers	68	49	28	22	10	11	11	11	11	11	11	2	2	247
Marketing	37	33	17	14	12	8	8	6	9	7	6	6	5	168
Logistics	45	32	20	16	14	7	7	7	2					150
Production	45	33	16	12	8									114
HR	24	19	14	8	6									71
IT	19	15	8	6	3									51
Maintenance	15	12	6	4	6									43
Purchasing	10	8	8	6	6									38
Total	413	307	185	144	118	52	52	50	48	44	43	22	21	1499

Sum of Reports	Country												
Division	Finland	Sweden	Poland	Lithuania	UK	Russia	Latvia	Estonia	Germany	Denmark	Norway	Ukraine	Byelorus	Total
BI	126	95	57	48	27	23	24	22	21	19	19	9	9	499
TI	102	75	61	41	16	14	14	14	13	12	12	7	6	387
PPS	100	74	21	21	75	15	14	14	14	13	12	6	6	385
Base	85	63	46	34										228
Total	413	307	185	144	118	52	52	50	48	44	43	22	21	1499

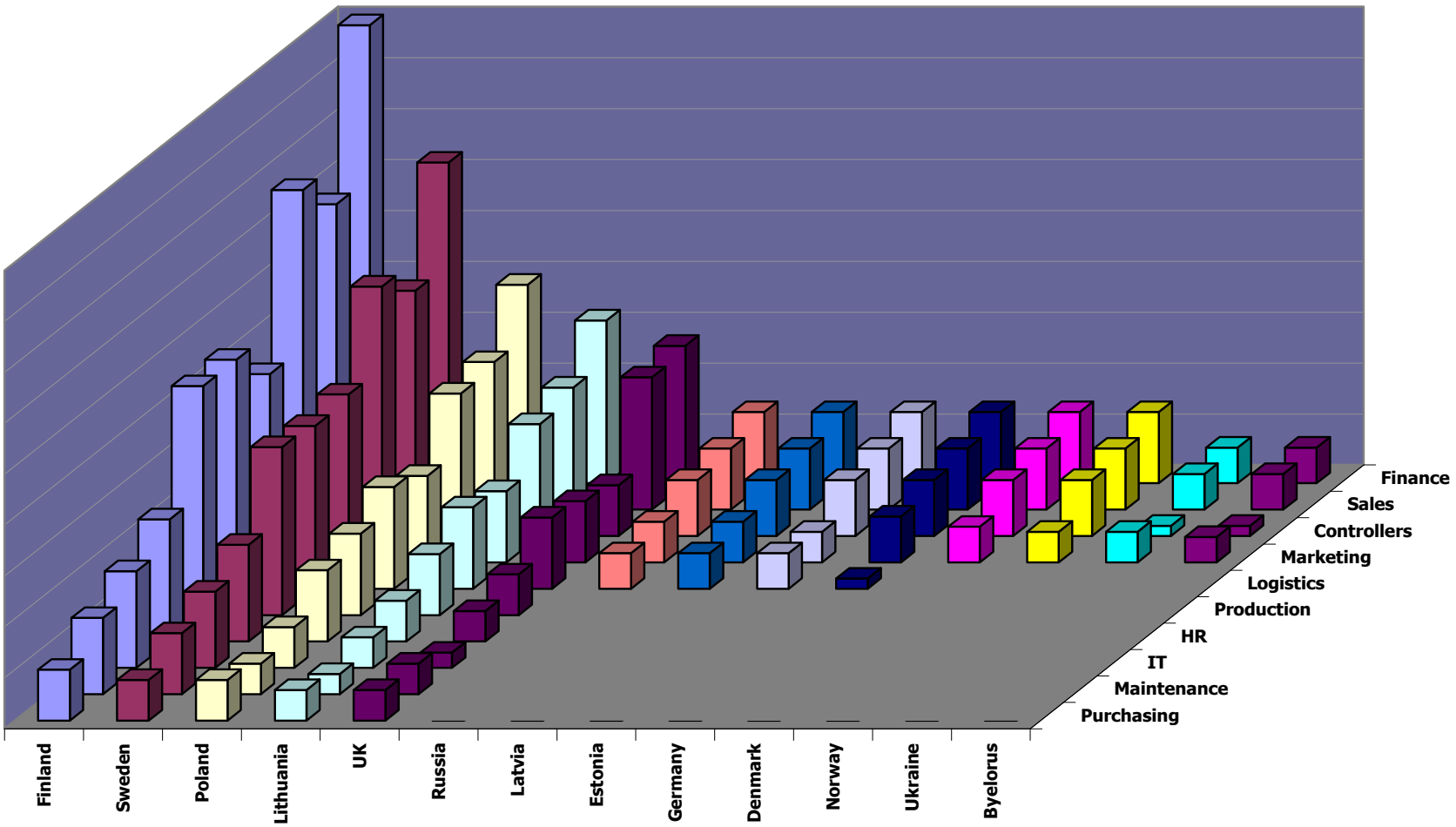
Country	(All)

Sum of Reports	Function										
Division	Finance	Sales	Controllers	Marketing	Logistics	Prod.	HR	IT	Maint.	Purch.	Grand Total
BI	129	129	91	76	54		11	9			499
TI	86	67	60	51	35	40	15	14	14	5	387
PPS	82	72	56	41	35	34	17	14	15	19	385
Base	52		40		26	40	28	14	14	14	228
Grand Total	349	268	247	168	150	114	71	51	43	38	1499

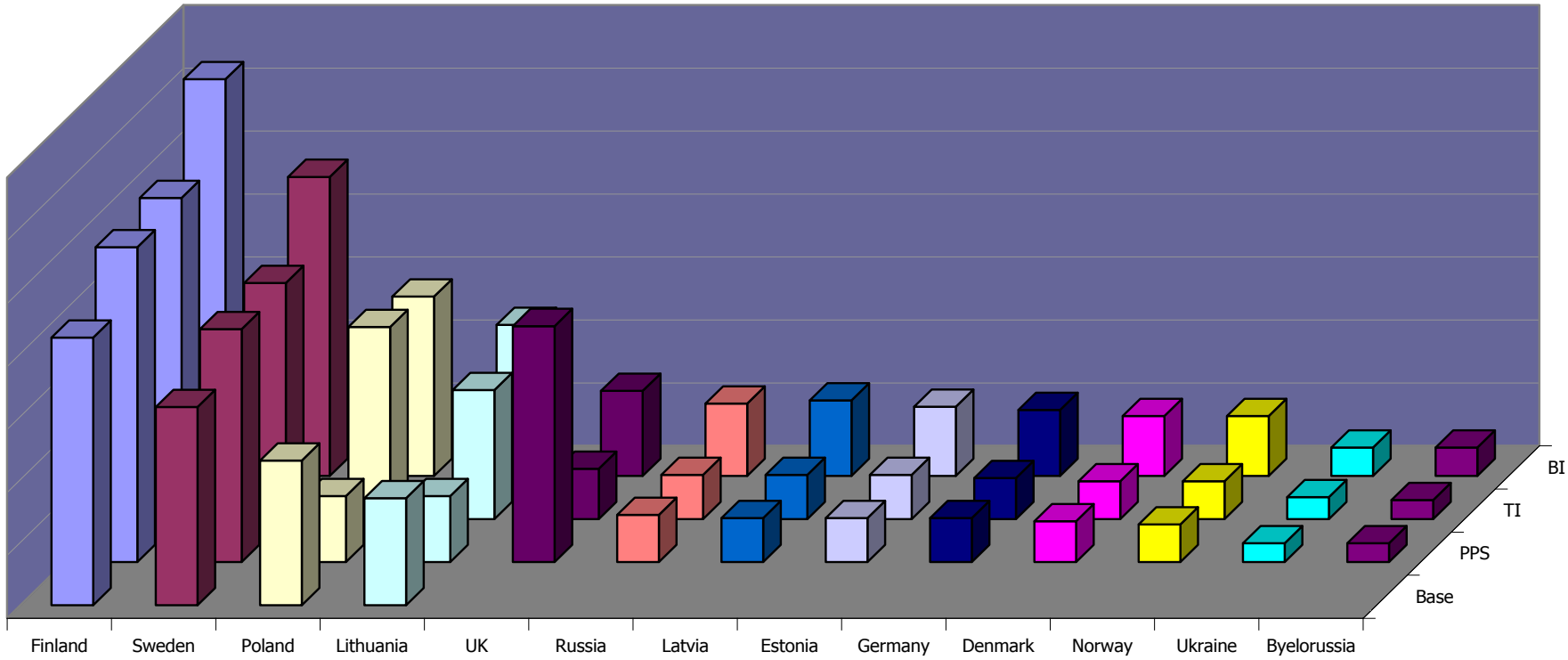
Actually 1499 number of reports is rather estimated than identified. Yes, huge part of reports is about same purpose, only from different angle. But anyway number 1499 is not overestimated. Perhaps only part of them is really final, Big Name Reports, others are more local and intermediate. Would be good if we could make a more exact definition of what is counted as report. Report is not equal report - some are only 1 page, some may be 10 or 100 pages, some are packaged in the ERP, more like querying interfaces, some made by IT providing "fixed" content, some made by users in Excel. If we consider each possible print-out as report, we would get many, many thousands of reports.

But even one real Big Name report gets multiplied by 42 instances (14 instances (13 countries + common PG) x 3 instances (BI, TI, total of country)). Sales have more than 10 different kinds of reports - it means that in PG there are more than 400 final Sales reports. From PG top point of view, it is only 10, but from all organization it is 400. That's the challenge - 1 PG report is made of those 40 country reports and therefore they are very important - missing or incorrect country report makes PG report incorrect. I will discuss it more in final BI strategy chapter.

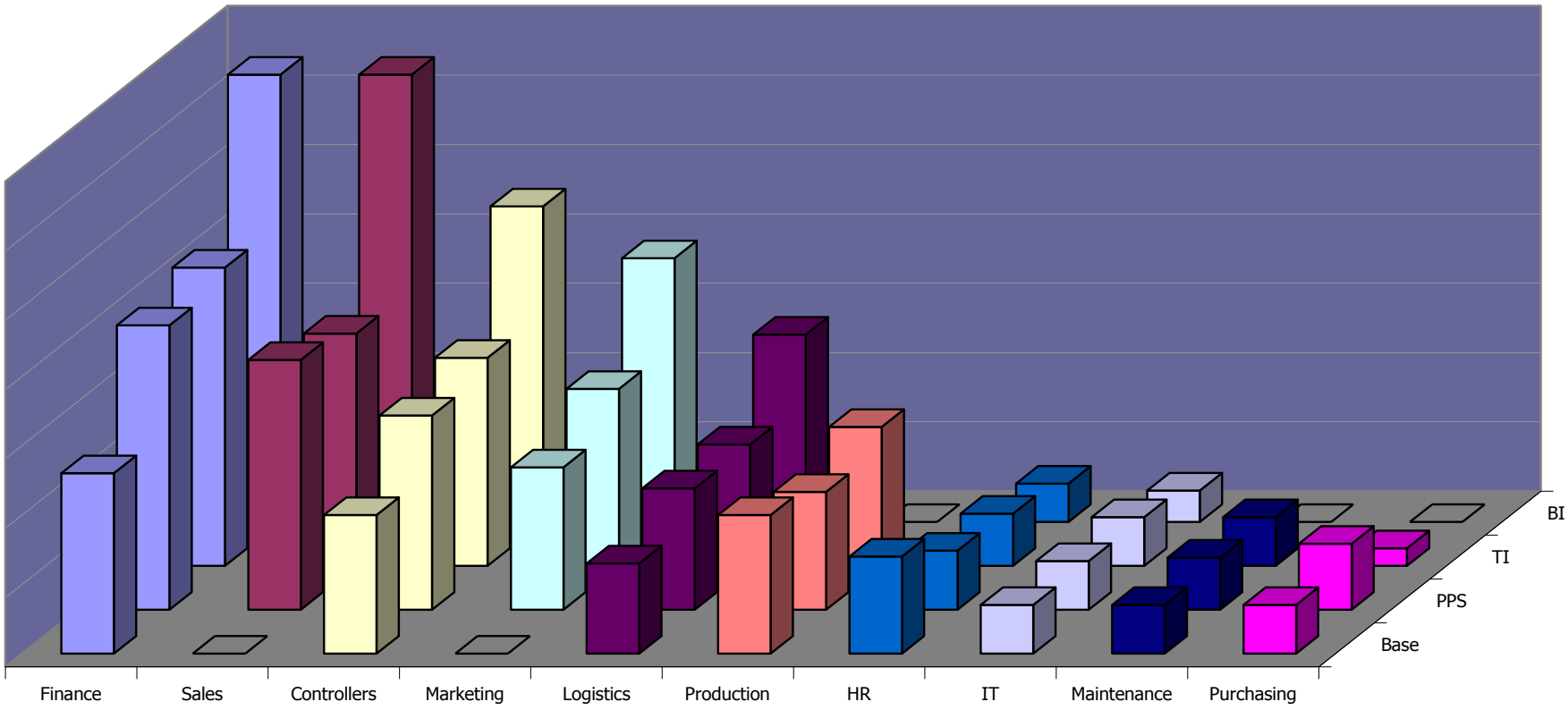
Reporting needs: Countries x Functions



Reporting needs: Countries by Divisions



Reporting needs: Functions x Divisions



So, here comes the challenge. How to collect and define those needs? Is that possible at all? Well, "everything is possible but nothing is easy". There could be several ways of doing it – collect from Countries, or from Divisions or from Functions. For me, most rational way, seems the last one. Would be best if business people, champions of Functions, would define those needs during ERP workshops. Sales people – PG sales needs, production – PG production needs, finance – PG finance needs and so on. Perhaps 50% of those needs are covered by IFS standard functionality.

Then here comes another, "long term challenge" - to fulfill rest of 50% needs. Hopefully unified/centralized PG BI developing team will gain enough resources and skills to make it true.

Unfortunately ERP is commonly supposed as IT project and therefore IT should collect, sort-out and fulfill business reporting needs. You may interpret this as an explanation or introduction to the further coming "message" that Core Task No 1. - Reporting Needs is not done as one (including me) would like to be done.

My idea and mechanism of mapping reporting needs was to have PG common Report Register with basic information about main ERP related reports and samples of those reports. Unfortunately, even this, quite easy and basic task, was too hard to some business departments. From Lithuania were mapped 133 reports, but it is not 100 % of all Lithuania need. Some people simply didn't have time to respond to IT initiative collect their needs. Here are some figures about collected reports:

	Reports collected	collected % of country needs	reports in English
Lithuania	**133**	**90%**	**90%**
Latvia	**30**	**60%**	**50%**
Finland	**96**	**25%**	**50%**
Poland	**19**	**10%**	**40%**
Sweden	**0**	**0%**	**?**

May be 3 weeks time period was too short, may be idea of Reporting Register was misunderstood, or may be simply, "wave of request" to identify all reports didn't spread far enough from IT community.

This only indicates that there is an organizational challenge to communicate BI needs. BI is on intersection of IT and Business world. It is quite often roles and areas of responsibilities are missing, duplicated or mistreated.

On other hand, from the feedback received, is obvious that meaning of some Reporting Register metrics is unclear. Some information is misinterpreted, some missing, some is not valuable. Every report should have its Business Owner, Designer, Data Source (Origin) and Destination. It is not so easy to specify it. Most useless metric appeared to be Priority – every person "weights" importance according his "scale". Who can state what is more important Sales or Production reports? Country, Division, or PG?

Which part of house is more important: foundations, holding constructions or roof? Local operative reports are "short term" business critical, Division and Group – long term business critical. And once again, local reports/information are the bricks of PG reporting house.

Despite that response from business about their reporting needs was not very active, it was quite enough to see overall reporting situation and even do same unexpected findings. E.g. in many countries, bigger part of reports is in local languages. That's makes detailed analysis towards reporting unification even more like "mission impossible".

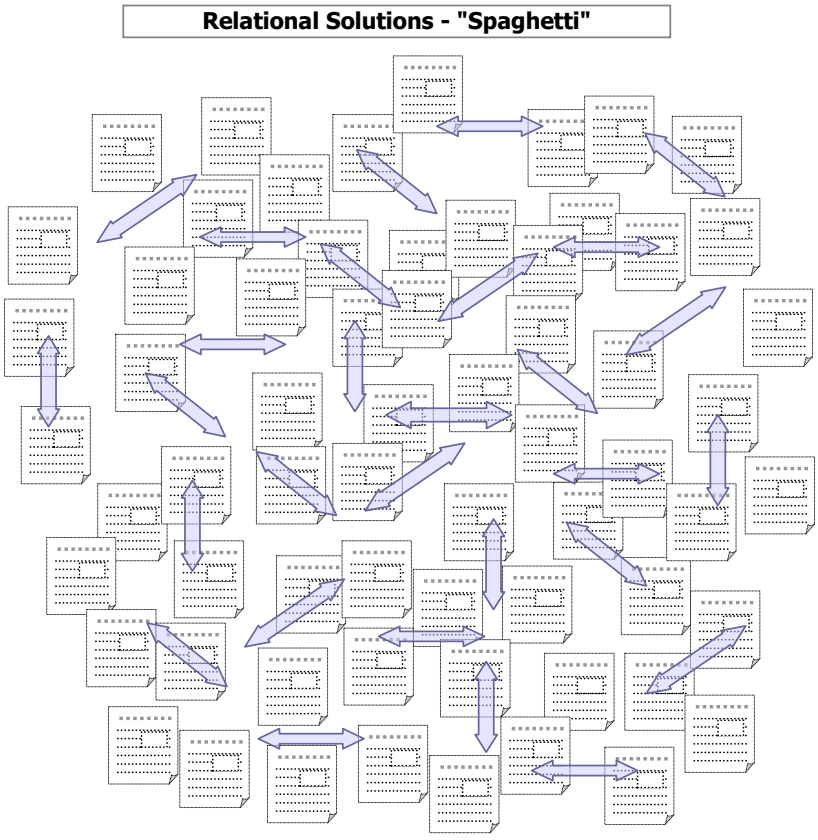
In Finland and Poland MS Access plays very important part in transforming IFS data to end user reports. Also Finland and Poland has not real OLAP tools, except "IFS data -> MS Access -> Excel Pivot Table" solution. Excel in all countries is most popular "reporting media". May be too popular – Excel worksheets are linked, nested and reused all around.

Anticipated finding was that Sales, Finance and Controllers have biggest share of different kind of follow-up reports. And also quite obvious finding was that the bigger country – the bigger reporting needs. Reports and information is like blood of company organism. And it has clear trend to grow.

Good finding was Building Insulation efforts to harmonize countries sales, profitability and overhead costs reporting. In BI Division Reporting Document Library, there are listed more than 200 reports. It is a very good sign that BI division is matured for Enterprise Business Intelligence solutions.

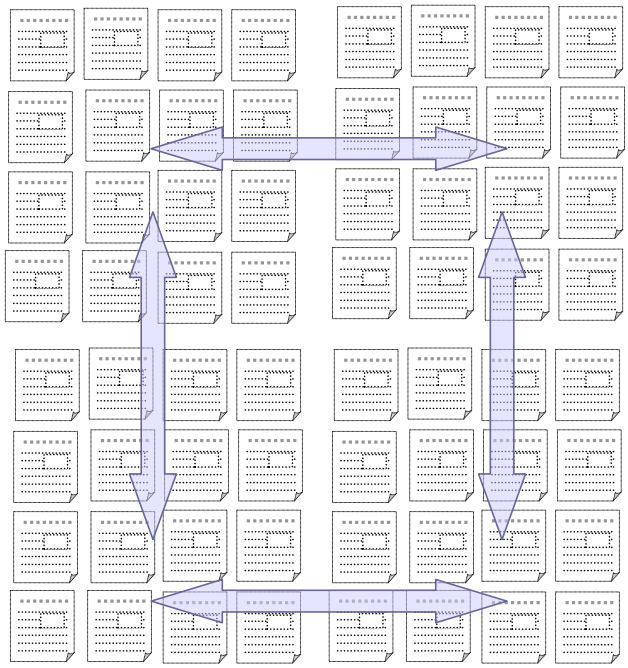
Despite the fact that not all countries were involved in reporting needs survey and even not all main business processes has reporting needs defined yet, I will try to sort-out anticipated reporting needs by processes based on my experience with Lithuanian OLAP solutions.

If we would try to analyze information relations in existing swarm of different reports, perhaps we would get similar picture like table relations in relational databases. Difference is that in DB it is in *normalized* form, while in unmanaged reporting environment it is rather chaotic:



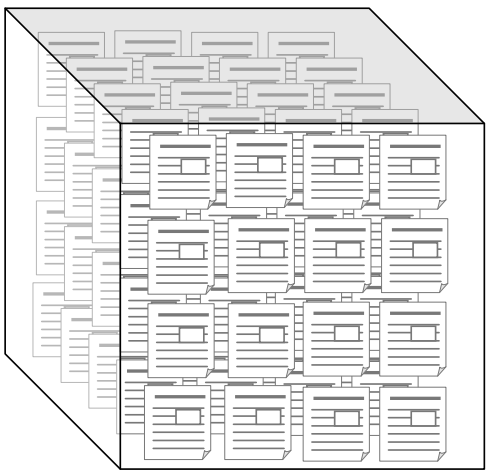
Usually people like order in simplicity (especially they expect that from others). If we try to sort out "spaghetti", we would see that something is overlapping, something duplicating and perhaps something missing. Despite that, perhaps some 90% of chaos can be eliminated by categorizing and identifying common relations in large scale picture:

Sorting-out Reports



Then it is quite easy to put it in 3D form which is more compact and conceptually elegant:

"Capturing" Reporting Needs into OLAP Cubes



Well done, but in practice is not as simple as in picture. This 3D form is kind of analytical workspace, or as often in the BI terminology called – OLAP cube. "Cube" is good metaphor, but not exact model. Multidimensional OLAP cube usually has more than 3 dimensions – let's say 10 is good to average. It is logically impossible and impractical to stuff all company's analytical workspace into one hyper-cube. But 10-20 cubes could cover main business processes of medium company.

For Paroc Group 10-20 hyper-cubes containing data from all countries in one hyper-cube per process would be a good BI target. OLAP cubes are very effective solution for both - analytical and regular follow-up reporting needs. However, largest part of operative reporting needs are more effectively supported by build-in ERP reporting functionality and by some customer specific "flat" reports developed by internal or external IT.

One cube based on ERP Sales Invoice Statistics could cover all Sales follow-up needs. If we manage to link invoice rows with Bonus, Freight, and Product_Cost data, we would also satisfy Profitability analysis needs. Then if we manage to track/link Warehouse, Batch_ID and Product Origin, same cube would meet some Logistic analysis needs. And finally for possibility to do analysis on PG total level, Country/Company and Sales Type (internal, domestic, export, etc) information should be added as analytical dimensions.

Sales Budget information could be mapped to same Sales cube, but perhaps would be more relevant to have it on separate, smaller cube. Budget is not as detailed and multidimensional as Actual Sales figures. While Act/Bud variance – main analytical follow-up indicator can show only what exist in both - Budget and Actual sides.

Turnover, Net Sales, Bonus, Freight, IP_Cost, Gross_Margin, Net Volume, Gross Volume and Tons would be main measures of Sales cube. From these primary metrics lots of calculated measures can be produced. It could be GM%, Price/m3, Price/ton, a lot of Year-To-Day (YTD) cumulative figures, Last Year (LY) figures, lot of YTD and LY indexes or some miscellaneous metrics like Sales Density. Number of measures can have multiplying trend. There may be need of several dozens of fiscal Sales metrics in local and foreign currencies. For example in Lithuania are used 4 "virtual" currencies, here is a matrix of all possible (but not all used) metrics:

LTL	EUR	kEUR	kLTL
Sales	Sales_EUR	Sales_kEUR	Sales_kLTL
Sales_YTD	Sales_EUR_YTD	Sales_kEUR_YTD	Sales_kLTL_YTD
Sales_B	Sales_EUR_B	Sales_kEUR_B	Sales_kLTL_B
Sales_B _YTD	Sales_EUR_B _YTD	Sales_kEUR_B _YTD	Sales_kLTL_B _YTD
Sales_LY	Sales_EUR_LY	Sales_kEUR_LY	Sales_kLTL_LY
Sales_LY_YTD	Sales_EUR_LY_YTD	Sales_kEUR_LY_YTD	Sales_kLTL_LY_YTD
Sales_IND_B			
Sales_IND_B_YTD			
Sales_IND_LY			
Sales_IND_LY_YTD			

Different currencies and its changing rates is main challenge in consolidating countries data into PG hypercube. There should be correct conversion to one currency – EUR. Another challenge is Bonus, Freight, IP_Cost and Sales Budget information. It is more country specific challenge, but very related with common ERP, business processes and reporting needs. It should be considered very well with IFS experts and Paroc Sales team how to reside mentioned information to IFS database, in order to make analysis and reporting as much as possible defined and reliable.

STUDY CHARTER

Here is proposed draft table of Sales cube dimensions with more detailed information:

Dimension	Levels	Hierarchy	comments
Time	3	Year-Month-Week	Time based on sales invoice date, could be 2 Time hierarchies - Monthly and Weekly
Company	2	Country - Company	legal company of Paroc from which sales invoice was issued (needed for consolidation legal company sales to PG sales)
Sales type	1	Type	Internal, Domestic, Export, etc (needed for consolidation legal company sales to PG sales)
Division	1	Division	BI or TI divisions, derivation from products PPG code or from GL accounting dimension
Origin	3	Country - Site - Line	Country of product Origin, production site,(prod. line - optional), challenging but very valuable information
Destination	2	Country - District	Country of sales destination, (district - optional)
Product	5	Group-Family-Name-Density-SKU	Product Group, Family, Name, Density, SKU. Could be split to 2 separated dimensions for analytical manipulations convenience
Product Categ	2	Category-SKU	products grouped by category: Fast, Normal, Special, Customer Specific, according SCM project
Warehouse	2	Group-Warehouse	warehouse from which sales were issued
Delivery Customer	3	Category-subcateg.-Customer	Delivery Customers
Invoice Customer	3	Category-subcateg.-Customer	Invoice Customers
Order Customer	3	Category-subcateg.-Customer	Order Customer
Logistic Operator	2	Operator-service type	Logistic Operator and way of delivery (optional)
Project	1	Project	Project, building object, special discount promotion (optional)
Bonus rule	1	Rule	(optional)

Here are main measures and calculated measures:

Turnover	= Gross Sales - Tax
Net Sales	= Turnover - Bonus Cost, (while Turnover = Sales - Road Tax)
Bonus	= Bonus to Customer, related to sales amount
Freight	= Freight_In_Cost + Freight _Out_Cost
IP cost	= Internal PRICE, costs based on IP, LTL
Gross Margin	= Net Sales - IP - Freight Costs - Export Distr Costs
Qty	= Sales m or m2
Net m3	= Technical volume
Gross m3	= Trasporting volume
Tons	= Net weight, based on Sales Density

Here is a one (of hundreds possible) Lithuanian Sale Cube layout which shows how it may look all together:

Time Monthly	2004
Warehouse	All Warehouse
Origin	Any Origin
Project	All Orders
Product BI_TI	All Products
District	All District
Deliv_Cust Category	All Deliv Customers
Delivery Customer	All Deliv Customers
Inv_Cust Category	All Inv Customers
Invoice Customer	All Inv Customers

	Data											
Prod Group	m3	tonnes	Sales	IND LY, Sales	GM	GM%	IP	Purchase Cost	Freight_In Cost	Freight_Out Cost	Bonus Cost	Lt/ton
BA11 Flexible slabs and mats	652,378	18,978	38,615,620	115	11,676,783	31%	24,206,701	3,166	3,217	1,780,852	749,499	2,035
BA12 Blowing wool	2,495	80	104,744	83	25,791	25%	63,744	1,690	1,658	14,699	8	1,312
BA13 Wall insul. slabs, boards	13,757	943	2,395,376	97	835,640	35%	1,494,413	99,127	33,693	52,631	1,002	2,540
BA14 Wind protection slabs	157	14	72,581	532	9,763	14%	61,673	49,472	12,201	797	0	5,276
BA21 Rendered fasades	24,731	2,699	5,299,267	135	979,962	19%	4,234,203	398,431	131,685	58,670	187	1,963
BA31 Roof insulation	89,369	9,629	16,652,306	126	2,834,328	17%	13,462,252	1,504,738	260,192	269,370	4,160	1,729
BA41 Concrete panel insulation	734	40	135,184	69	30,180	22%	102,392	52,218	38,747	1,890	73	3,350
BA42 Metal faced panel insulat	724	65	121,045	4	24,802	21%	95,616	0	0	0	0	1,859
BA51 Fire protection	359	49	131,333	270	61,899	47%	67,636	0	0	1,125	38	2,691
BA71 Ground insulation	6,777	610	1,319,956	97	374,751	29%	926,791	0	0	11,603	239	2,164
BS91 Other products/services	0	0	4,698	141	70	1%	4,606	4,214	392	0	0	
TA11 Pipe sections	960	64	642,872	86	100,711	16%	533,937	504,788	29,149	5,083	55	10,021
TA21 Wired mats 100 kg/m3	330	31	105,155	97	19,938	19%	83,964	78,047	5,917	746	2	3,358
TA22 Wired mats 80 kg/m3	1,985	156	511,063	92	97,451	19%	402,802	365,395	37,407	8,242	115	3,267
TA23 Wired mats 65 kg/m3	4	0	897		186	21%	699	639	60	8	0	3,832
TA31 Lamella mats	11,675	747	3,095,742	254	510,518	17%	2,516,684	2,201,624	315,060	53,106	574	4,142
TA41 Special tailored products	14	3	14,781		2,012	14%	12,637	11,746	891	61	0	4,526
TA51 On-line slabs < 60 kg/m3	373	14	32,079	36	14,018	44%	17,279	0	0	613	0	2,327
TA52 On-line slabs >=60 kg/m3	2,823	169	302,111	106	70,568	23%	224,329	0	0	5,690	0	1,784
TA53 On line slabs >=80 kg/m3	945	78	233,345	129	49,134	21%	180,389	116,947	24,640	2,681	0	3,002
TA54 On-line slabs >=100 kg/m3	730	80	199,975	83	90,785	46%	105,912	9,120	878	2,216	87	2,504
TA55 Other on-line mats	1,822	116	269,364	73	99,920	37%	164,109	0	0	3,979	6	2,312
TA56 LW mats	39	2	6,440	15	1,714	27%	4,550	3,335	1,215	145	0	2,778
Grand Total	813,178	34,570	70,265,934	113	17,910,925	26%	48,967,315	5,404,696	897,002	2,274,208	756,043	2,033

And here is description of all measures used in Lithuania Sales cube:

Data	units	description of the Measure (factual figure)
Bonus Cost	LTL	Bonus to Customer, related to sales amount
Density, kg/m3	kg/m3	= Tones / Tech_Volume
EUR/ton	EUR	= Sales, EUR / Tonnes
EUR/ton, LY	EUR	EUR/ton, Last Year's adequate period
Export Distr Cost	LTL	Custom fees, allocated from General Ledger (account = 4730 or 4750)
Freight Cost	LTL	= Freight_In_Cost + Freight _Out_Cost
Freight_In Cost	EUR	Transporting costs of imported products, allocated from Stock Transactions (assuming that transp. costs = all prod.cost - purchase price)
Freight_Out Cost	LTL	Transporting cost to client in Lithuania, allocated from SCALA General Ledger (account = 4700, Product = TR LT)
GM	LTL	Gross Margin = Net Sales - IP - Freight Costs - Export Distr Costs, LTL
GM%	%	= Gross Margin/Net Sales, %
GM, kEUR	1000 EUR	Gross Margin, EUR
GM, LY	LTL	GM, Last Year's adequate period, LTL
GP	LTL	Gross Profit = Net Sales - PK3 - Freight Costs - Export Distr Costs (same principle as GM only instead of IP is used PK3)
GP Scala	LTL	Gross Profit from Scala Statistics, GP = Sales - PK3
GP%	%	= Gross Profit / Net Sales, %
IND LY, EUR/ton	%	Index = (EUR/ton) / (EUR/ton, LY)*100
IND LY, GM	%	Index = GM / GM, LY
IND LY, Sales	%	Index = Sales / Sales, LY
IND LY, tonnes	%	Index = tonnes / tonnes, LY
IP	LTL	Internal Price, costs based on IP, LTL
IP, Lt/ton	LTL	= IP/ tonnes
Lt/m3	LTL	= Sales / Tech_volume
Lt/ton	LTL	= Sales / tonnes
m2	m2 or m	Sales Qty, m2 (for pipes - m)
m3	m3	Sales gross (transporting) volume, m3
NAF	LTL	Net sales After Freights, (= Net Sales - Distribution Costs)
Net Sales	LTL	= Turnover - Bonus Cost, (while Turnover = Sales - Road Tax)
Net Sales, kEUR	1000 EUR	Turnover - Bonus Cost
PK3	LTL	PK3 cost, may be different from IP
Purchase Cost	LTL	Imported product actual Purchase (net price) Costs excluding Freight and Import fees
Road Tax	LTL	= Sales * 0,0048
Sales	LTL	Gross Sales (based on invoiced amount), LTL
Sales kEUR	1000 EUR	Gross Sales, 1000 EUR
Sales, LY	LTL	Sales, Last Year's adequate period, LTL
Tech_Volume	m3	Sales net (technical) volume, m3
tonnes	ton	Sales Tonnes = Tech_Volume * Sales Density
tonnes, LY	ton	Last Year's adequate period Sales Tonnes
YTD EUR/ton	EUR	Year To Date (YTD) - cumulative amount from beginning of the year up to selected month
YTD EUR/ton, LY	EUR	Year To Date ...
YTD Freight Cost	LTL	YTD...
YTD GM	LTL	YTD...
YTD GM%	%	YTD...
YTD GM, kEUR	1000 EUR	YTD...
YTD GM, LY	LTL	YTD...
YTD GP	LTL	YTD...
YTD GP%	%	YTD...
YTD Lt/m3	LTL	YTD...
YTD Lt/ton	LTL	YTD...
YTD m2	m2 or m	YTD...
YTD m3	m3	YTD...
YTD Net Sales	LTL	YTD...
YTD Net Sales, kEUR	1000 EUR	YTD...
YTD PK3	LTL	YTD...
YTD Sales	LTL	YTD...
YTD Sales kEUR	1000 EUR	YTD...
YTD Sales, LY	LTL	YTD...
YTD Tech_Volume	m3	YTD...
YTD tonnes	ton	YTD...
YTD tonnes, LY	ton	YTD...

Sales Cube is quite typical and perhaps most valuable BI tool, helping company increase Sales, improve Customer Relationship Management and successfully compete in the market. However, even though its structure is clear and understandable, profitability analysis needs, especially Bonus and Freight information requires a lot of specific background calculations and linking. That makes

Sales Cube demanding for regular supervision and maintenance. 100% accuracy and reliability is hardly achievable.

Next largest functional need is related with financial accounting. There are much more financial (also made by controllers department) reports than sales or production. Perhaps ¾ of reports are all about money. ERP financial General Ledger is the place where all information is stored. It takes biggest part of ERP disk storage and requires most of server performance. Not all companies have realized possibly and benefit of building General Ledger Cube. Although it requires a lot of computer capacity, to build GL cube is not as difficult as Sales/Profitability. In fact GL accounting dimension are ready made cube dimensions, and there is only on measure – money ! Time dimension is very simple, Transaction and Transaction_Type dimensions also are quite simple but not always needed. So where is the challenge?

Question is usability of GL Cube – there is one condition for that. ERP GL Accounting Dimension must be simple, clear and logical in order to make effective cross-dimensional manipulations for the user. While many companies' ends in quite messy situation of various accounting segments. Accounting architects tries to balance between legacy segments and new needs for emerging and changing business processes. Paroc is very much in this situation – current logic of accounting dimensions is far from perfect. That will be root for many accounting and reporting problems which will require more accountants' time, and anyway, makes some reporting information unavailable and unreliable.

I had not much time and perhaps it shouldn't be my concern to analyze new PG accounting dimensions, but it is obvious that some of them are mixed, fragmented and duplicated. That complicates reporting and follow-up. In ideal accounting structure, one dimension should explicitly mean one thing. Account – should remain quite not detail, rather similar to 100 hundred years old classic Income Statement and Balance Sheet chart of accounts. Rest of accounting dimensions should identify more detail relations of booked amounts with the objects/subjects like Product, Project, Market, Assets, Cost Centre, Activity, Department, Division and so on.

Usually number of accounting dimension is limited by system or by natural accountant wish to have everything in few dimensions. Then, it is quite acceptable if two completely not related "things" are put in one dimension. E.g. this could be applied to **Production_Equipment** (or line zones) and **IT Software&Hardware**. Those 2 things perhaps will never make a collision in case of certain cost must by identified as **Production_Equipment** and **IT costs** - e.g. **Cupola zone** and **ERP**. If so, 2 "things" can be coded with 2 different running sequences in same dimension, making 2 separate alphanumeric spaces. But be careful - there might be a certain cost, making combination of e.g. **Scales Equipment** and **PRIPS** possible !

Reporting Levels can dramatically improve chart of accounts structure. Perhaps some 2 or more dimensions is possible to map into 2 levels of same dimension, e.g. like Division-Department, or Department-Cost Centre. But again, be careful with configuring-out all possible combinations.

Worst think is then same "things" are duplicated and scattered across several accounting dimension. It may require a lot of manual work to collect them into the needed report. In new PG Cost Centers list, it is possible to find combinations meaning country, equipment, line-zone, department, activity, account and of course Cost Centre (meaning functions, groups of employees). Similar things may be found in other dimensions.

It is not easy task to design chart of accounts and it is even much more painful to change it. It is core of accounting system and related with all modules of ERP. It is a real puzzle, solvable perhaps only by some workshop of business accountability competence centre.

During Paroc Group Scala harmonization couple year ago, external consultants recommended to stick to these 6 dimensions:

- Account
- Cost Centre
- Product Group
- Project
- Product Origin
- Destination

However, it looks too simple to meet current Paroc Group accounting realities. At least 3 things missing - Activity, Legal Company and Division. Last two are also related with Hyperion entities. But if ERP GL accounting structures are designed and implemented properly, perhaps Hyperion not needed anymore - Paroc Group financial consolidation is possible within IFS database. That would be a good long term target for financial business intelligence.

For the end of financial BI I would like to point out one more challenge – typical ERP system functionality works well with typical dimensions, like cost centre, project, product, even country and company, but split of some transactions by Division may needs some ERP modifications. It applies to both Scala and IFS. At the moment I'm writing this study, we have problem that in new fiscal year particular modification – SQL-trigger splitting Account Receivables to Divisions - doesn't work... **Generally, Division as financial dimension complicates accounting and reporting a lot, it also increases number of reports to produce and maintain**. But everything is doable if really needed.

To illustrate GL Cube here is one non-confidential sample from UAB Paroc, Year 2003:

Act	All Act
CostCentre	All CC
Credit_Debit	All Transactions
Empl Nr	All Empl Nr
Product	All Prod
Project	All Proj
Proj	All Proj
Transaction Type	Regular Transactions
Transactions	All Trans Nr

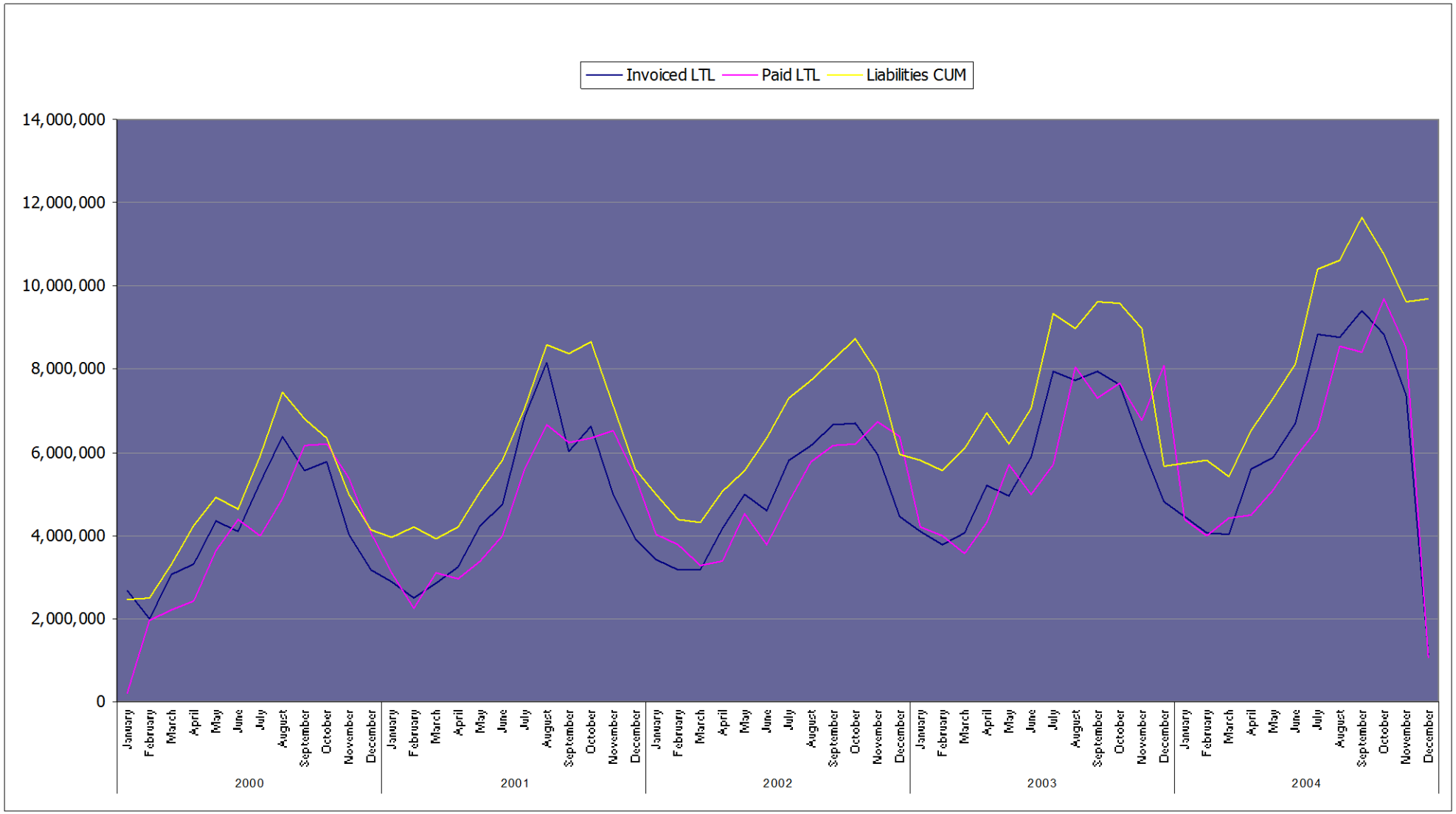
Amount		Year	Quarter				
		2003				2003 Total	Grand Total
Class	Acc	Quarter 1	Quarter 2	Quarter 3	Quarter 4		
3	3011 Sales Own production ,PVM	-7362826.24	-10164051.93	-16607813.49	-12890537.76	-47025229.42	-47025229.42
	3012 Sales Traded products,PVM	-823151.56	-1245417.11	-2598977.92	-2597134.6	-7264681.19	-7264681.19
	3015 Sales export	-4393810.16	-5957104.35	-7507513.8	-5307295.48	-23165723.79	-23165723.79
	30811 Discounts Own prod. PVM	1964985.13	2674506.14	4620520.09	3188481.91	12448493.27	12448493.27
	308111 Discount for LD turnover	14677.51	73036	241180.57	399468.95	728363.03	728363.03
	30812 Discounts Traded prod.PVM	245876.82	375829.8	1014946.49	1014269.93	2650923.04	2650923.04
	30815 Discounts export	8699.19		5978		14677.19	14677.19
	30821 Credit inv. Own prod. PVM	2749.9	70341.46	32845.84	12636.48	118573.68	118573.68
	30822 Credit inv. Traded pr.PVM			368.64	718.4	1087.04	1087.04
	30825 Credit inv. export	15021.65		22290.04		37311.69	37311.69
	3620 Freight		-175			-175	-175
	3621 Freight export	-11394.25	-6387.67	-7596.16	-17022.3	-42400.38	-42400.38
	3890 Other operating income	-400959.29	-149782.68	-143317.22	-185151.52	-879210.71	-879210.71
	3990 Other income	-80276.76	-203650.24	-262816.24	-238596.7	-785339.94	-785339.94
3 Total		-10820408.06	-14532855.58	-21189905.16	-16620162.69	-63163331.49	-63163331.49
Grand Total		-10820408.06	-14532855.58	-21189905.16	-16620162.69	-63163331.49	-63163331.49

Another very usable cube for both Finance and Sales departments is Sales Ledger. It gives possibility to track customers payment habits, categorize and sort them from good to bad, see what are current liabilities, due, overdue balances, crediting and bad debts costs.

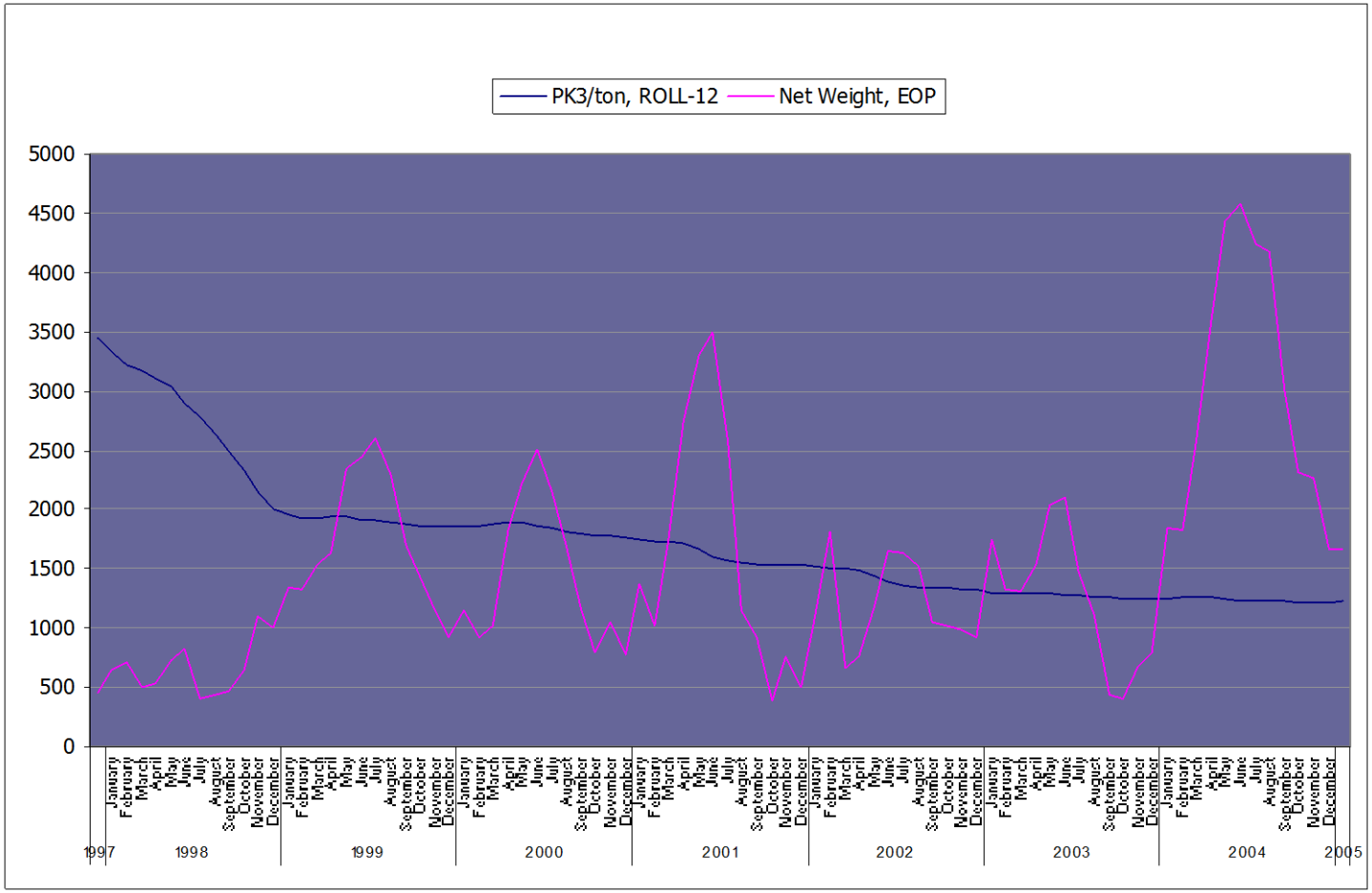
Here are descriptions from current Lithuania Sales Ledger Cube:

Dimensions:				
Activity	GL accounting dimension "Activity": like BILI, BILS, TILI, etc.			
District	Customer country			
Cust_Categ	Customer categories			
Customers	Customer names			
Customer Status	Customer Status at present time: e.g. Due, No Due, Overdue >360, Overdue 181-360d, …, etc.			
Invoice Status	Invoice Status. An invoices can be either Paid or Liability. (3rd type is Advance Payment)			
Invoice Date	Customer Invoice Date			
Payment Date	Customer Payment Date			
Fact Data/Measures:				
Invoiced LTL	Invoiced amount in LTL (with VAT)	** All amounts are with VAT*		
Paid LTL	Paid amount, LTL			
Liabilities LTL	Invoiced amount - Paid amount, LTL			
EUR, Liabilities	Invoiced amount - Paid amount, EUR			
kEUR, Liabilities	Invoiced amount - Paid amount, kEUR			
Overdue LTL	Total overdue amount, LTL			
kEUR, Overdue	Total overdue amount, kEUR			
LTL 0_6	Amount, overdue less than 7days, LTL			
LTL 7_30	Amount, overdue more than 7 days, LTL			
LTL 31_60	Amount, overdue more than 30 days, LTL			
LTL 61_180	Amount, overdue more than 60 days, LTL			
LTL 181_360	Amount, overdue more than 180 days, LTL			
LTL over 360	Amount, overdue more than 360 days, LTL			
EUR, Over 60d	Amount, overdue more than 60 days, EUR			
EUR, Over 90d	Amount, overdue more than 90 days, EUR			
EUR, Over 120d	Amount, overdue more than 120 days, EUR			
kEUR, >360d	Amount, overdue more than 360 days, kEUR			
kEUR, 181-360d	Amount, overdue more than 180days, kEUR			
kEUR, 60-180d	Amount, overdue more than 60days, kEUR			
kEUR, 31-60d	Amount, overdue more than 30days, kEUR			
kEUR, 7-30d	Amount, overdue more than 7days, kEUR			
kEUR, 0-6d	Amount, overdue less than 7days, kEUR			
Invoices	number (count) of invoices			
Due, d	Due day, calculated in weighted average principle			
Paid, d	Paid in days, calculated in weighted average principle			
Overdue, d	Overdue days, calculated in weighted average principle			
Overdue Cost LTL	Overdue, d x Invoiced amount x 0.02% (7% interest rate per year).			
Credit Cost LTL	Paid, d x Invoiced amount x 0.02% (7% interest rate per year).			
Overdue L, %	Ratio Overdue / Liabilities			
Overdue T, %	Ratio Overdue / Turnover (for rolling last 365 days)			
Customer's info fields:	**** Available to choose from Pivot Table / Property Fields menu***			
Paym Term	Customer Payment Term, days			
National ID	Company national register number			
Country	Customer Country of Origin			
Customer ID	Customer Code in SCALA			
Turnover kLTL	Customer turnover for rolling last 365 days, kLTL			
Turnover kEUR	Customer turnover for rolling last 365 days, kEUR			
Credit Limit	Customer Credit Limit, LTL			
Credit Limit EUR	Customer Credit Limit, EUR			
Credit Limit kEUR	Customer Credit Limit, kEUR			
Last Paym Date	Last Payment Day			
Last Due Day	Last Due Day			
Oldest Due Day	Oldest Due Day			
Last Invoice Day	Last Invoice Day			
extra days	Last Invoice Day - Oldest Due Day. If it more then 60 days, credit insurance does not cover those deliveries			

MS Excel Pivot Table functionality is client front-end tool to interact with OLAP cubes. It also has interactive Graphical visualization very familiar to Excel users. Here is one nice graphical chart from Sales Ledger Cube:



Purchase Ledger (PL) cube is very similar but from business point of view opposite to Sales Ledger cube. It is a useful tool for several departments, mostly for Purchasing. Since PL Cube contains more financial information, Stock (Inventory) cube is also very good for purchasing and logistics needs. Stock Turnover cube is one of most interesting cubes. It was made to calculate by SCM project initiated Stock Turnover indicator. But it also shows current and historical Inventory balances in qty, m3, ton and value in LTL. Here is one graphical trend showing seasonal inventory balance peaks and going down PK3/ton moving average.



As last but really not least reporting/analysis need by process, I'd like to mention, is Base Production Key Figures. There is a one cube made from PRIPS database which is in Oracle. MS OLAP Server can use Oracle as data source via intermediate SQL storage or directly. PRIPS comes with quite sophisticated Excel macros for reporting, but is has no good analytical interactivity. Thanks to Lasse Johansson very well defined Key Figures formulas, it was not hard to build PRIPS cube containing 10 dimensions and 46 measures :

Vilnius, L1 — Key Figures report

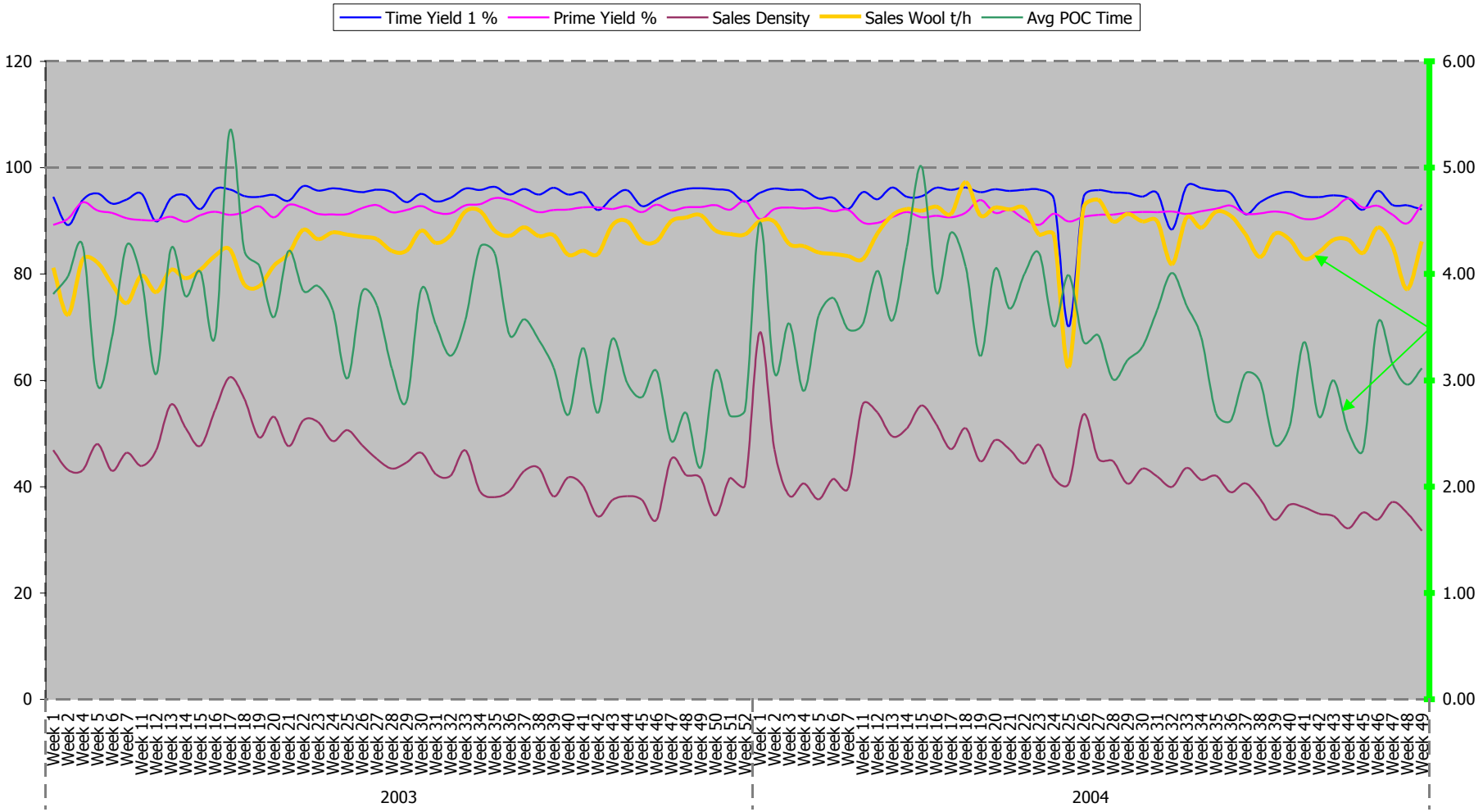
Data

Year	Week	Sales Wool ton	Act Wt Sales Wool ton	Scrap Wool ton	Scrap to Waste ton	Gross Prod ton	Rock ton	Melting Capacity t/h	Sales Wool t/h	Spec Prod t/h	Poss Spinn Time	Eff Spinn Time	Time Yield 1 %	Material Yield %	Sales Wool Yield %	Format Yield %	Coke %
2004	Week 52	431	454	18	3	502	622	6.83	4.74	5.15	91.0	86.7	95.3	69.3	95.0	96.6	16.7
	Week 51	484	510	30	7	577	763	6.82	4.32	4.76	111.9	103.2	92.2	63.4	95.0	95.6	17.1
	Week 50	682	723	45	18	819	1068	6.55	4.18	4.59	163.0	148.7	91.3	63.8	94.3	95.9	16.8
	Week 49	660	695	34	22	778	992	6.57	4.37	4.78	150.9	143.2	94.9	66.5	94.9	96.0	17.0
2004 Total *		**32840**	**34710**	**1942**	**533**	**38992**	**49521**	**6.61**	**4.39**	**4.76**	**7487.2**	**7048.1**	**94.1**	**66.3**	**94.6**	**97.2**	**16.6**
2004 Budget		29737	31488	1900		35078			4.35		7231	6858	94.8		94.5		

Data

Year	Month	Sales Wool ton	Act Wt Sales Wool ton	Scrap Wool ton	Scrap to Waste ton	Gross Prod ton	Rock ton	Melting Capacity t/h	Sales Wool t/h	Spec Prod t/h	Poss Spinn Time	Eff Spinn Time	Time Yield 1 %	Material Yield %	Sales Wool Yield %	Format Yield %	Coke %
2004	December	2370	2508	129	46	2817	3598	6.73	4.43	4.87	534.8	501.2	93.7	65.9	94.5	96.0	16.9
	November	2797	2975	185	80	3369	4381	6.57	4.20	4.64	666.5	622.0	93.3	63.8	94.1	96.3	16.7
	October	2891	3061	187	83	3459	4422	6.50	4.25	4.69	679.9	643.1	94.6	65.4	94.5	96.5	16.6
	September	2879	3053	181	81	3443	4424	6.67	4.34	4.75	663.7	621.4	93.6	65.1	94.3	96.7	16.6
	August	3083	3263	167	22	3647	4649	6.69	4.44	4.81	694.5	656.8	94.6	66.3	94.5	97.6	16.6
	July	3137	3345	185	25	3754	4680	6.77	4.54	4.92	690.7	656.8	95.1	67.0	93.8	97.4	16.3
	June	2738	2904	188	14	3287	4153	6.32	4.17	4.49	657.4	586.0	89.1	65.9	94.3	97.5	16.3
	May	3192	3344	177	21	3729	4603	6.68	4.63	4.96	689.0	659.9	95.8	69.3	95.4	97.8	16.1
	April	3115	3254	175	16	3643	4510	6.71	4.64	4.97	672.0	641.8	95.5	69.1	95.7	98.0	16.2
	March	2331	2423	151	77	2732	3494	6.55	4.37	4.69	533.3	506.7	95.0	66.7	96.2	98.3	16.7
	February	1429	1530	78	25	1711	2243	6.56	4.18	4.58	342.0	319.6	93.5	63.7	93.4	97.3	17.4
	January	2877	3049	139	41	3400	4364	6.58	4.34	4.64	663.3	632.7	95.4	65.9	94.3	97.2	17.2
2004 Total *		**32840**	**34710**	**1942**	**533**	**38992**	**49521**	**6.61**	**4.39**	**4.76**	**7487.2**	**7048.1**	**94.1**	**66.3**	**94.6**	**97.2**	**16.6**
2003		30852	31471	1589	525	35291	45775	6.29	4.24	4.40	7272.9	6887.7	94.7	67.4	98.0	97.0	16.8
	2002	26279	25891	1132		28844	39485	5.91	3.74		7029.0	6677.6	95.0	66.6	101.5		
	2001	22229	22025	1401		24872	36844	5.92	3.32		6687.0	6218.9	93.0	60.3	100.9		
	2000	18074	18132	1673		20797	31591	5.79	3.01		6010.0	5457.1	90.8	57.2	99.7		
	1999	18274	18155	1670		20995	32182	5.53	2.83		6462.0	5822.3	90.1	56.8	100.7		

And here is my best-try to represent some Production Key Figures' trends of last 2 years:



Here is a table with all Lithuanian OLAP cubes and its scheduled refresh time intervals. Note that some "light-weight" cubes are refreshed every working hour, making some cubes quite good tool for operative follow-up.

Cube Name	Adm	Fin	Prod	Maint	Purch	Log	Mark	Update Schedule
General Ledger		x						7:30, 13:30
GL Budget	x	x						0:00
Budget Public	x	x	X	x	x	x	x	0:00
PA	x	x						0:00
L2 Project		x						8:15, 10:15, 12:15, 14:15, 16:15, 18:15
Low Movement		x	X	x	x	x		8:00, 9:00,10:00.....20:00
Order Lines		x				x		8:00, 9:00,10:00.....20:00
PBX	x	x	X	x	x	x		0:00
Purchase Ledger		x		x	x	x		8:00, 9:00,10:00.....20:00
Sales Ledger		x					x	8:35, 9:05,9:35,10:05,10:35
Sales		x				x	x	8:35, 9:05,9:35,10:05,10:35
Stock Control						x		8:00, 9:00,10:00.....20:00
Stock Turnover		x		x	x	x		7:30, 13:30
PRIPS Cube			X	x		x		7:30, 8:30, 9:30.....19:30
Sales LV								22:00
Sales EE								23:00

There are two "foreign" Sales cubes - for Latvia and Estonia. They are not so much developed like Lithuanian Sales cube "brother", but anyway it is an interesting fact, that Latvia/Estonia users can remotely access Lithuania MS OLAP server from their Excel worksheets and do some analysis without significant delay.

For the end of Needs Assessment chapter I'd like to mention that there are some country specific processes. One of the most critical needs for Finland and Sweden is blowing wool report. It is needed for Sales but it is not only about sales. Report shows blowing contractor and compensation to it. Report Layout seems quite simple to me, concern is rather about data availability in the new ERP and change of ERP data structures and links.

To illustrate the need, here is report fragment about URAKOITSIJA contractor:

TILITYSLASKELMA/VILLAT	1.11.2004	-	30.11.2004							
	URAKOITSIJA	*PI-nro*	*KUVAUS*	*MÄÄRÄ*	*MYYNTIARVO*	*MK/M3*	*LISÄKORV.*	*PERUSPALK.*	*YHTEENSÄ*	*PALKKIO/M3*
	11	*ANPE OY*								
		40002	BLT 6 PA	483,7	8 553,76	17,68	0,00	3 655,70	3 655,70	7,56
		40014	BLT 6EX	1816,1	33 660,02	18,53	0,00	13 456,96	13 456,96	7,41
		40001	BLT 6 LV	13468,75	248 760,53	18,47	0,00	108 196,10	108 196,10	8,03
			Yhteensä	15768,55	290 974,31	18,45	0,00	125 308,75	125 308,75	7,95
			Arvonlisävero	27 567,93						
			Yhteensä verollinen	152 876,68						
23. joulukuuta 2004	*Sivu*									

urakoitsija = blow wool contractor
määrä = quantity (m3)
sales value =eur
mk/m3 = should be eur/m3
lisäkorv. = extra compensation (eur)
peruspalk. = main compensation (eur)
yhteensä = total
palkkio/m3 = compensation/m3
Arvonlisävero = TAX
yhteensä verollinen = total incl. Tax is In

Core Task No 2 - Needs Categorization

Needs Categorization is not so heavy task as Needs Assessment, however categorization can also be made by several criteria like:

- **Operative – Follow-up**
- **Local – Global**
- **Internal – External**
- **Business Critical – "Nice to have"**
- **Technology A – Technology Z**

Every criteria is like a dimension of the categorization matrix, but let's try to picture in more simple form, e.g. like this:

Operative		Follow-up			
IFS integrated	IFS outside	Regular	Analytical	Ad-hoc	via DW

And "to complicate a bit" the categorization, we could consider report **destination** as another dimension of categories:

Legal/Statutory	Business partner	Company internal	Area	Division	PG

Operative - IFS integrated

Perhaps most business critical is Operative Reports. It is quite standard business needs and therefore well-known for ERP vendors. Usually 90% of those needs come packaged with ERP. But anyway there are quite important needs to customize layout of print-outs, especially for official documents and reports with destination to external partners and institutions.

For those top-business-critical operative print-outs there is special team coordinated by Arja Konttinen. Samples of different Invoice types, Order Confirmation, Picking Lists, and Payment Reminders were collected from all countries. IFS Report Designer is a tool supposed to be used for PG common layout designing. Target is to have one common layout for all countries. Challenge is multi-language requirement. Headers and labels will be translated by system automatically based on company or customer language parameter. However length of words in different languages is different. Could occur so, that in some language long labels simply overlap, causing unacceptable view of print-out. Also in print-out footer there is a legal company attributes like address, VAT code, and Banking information. It is quite hard to fit different company attribute in one form – simply some companies may have different number of banks or bank accounts. Could happen so

that every company will have own set of layouts. That would increase number of operative reports at least 10 times. Report designers would have more work to maintain, update it. Furthermore Report Designer would have difficulty to configure out foreign language labels.

Operative - IFS outside

There may be quite big number of operative reporting needs which are not driven with IFS reporting tool arsenal - Report Builder, Report Designer, Report Generator and Quick Reports. MS Access, MS Excel or Crystal Report, may be linked directly, or via IFS Information Access Layer (IAL) with IFS database and used for extracting operative business information.

Follow-up Regular

This report category is perhaps largest one. There are hundreds regular follow-up reports generated monthly or weekly. Some of them are ready made in current ERP, some developed by IT, some are made manually or semi manually with MS Office tools like Excel, Access or even Word. Microsoft recently have introduced very powerful product MS Reporting Services. It is supposed to be used as Enterprise Business Intelligence Suite (EBIS) for medium and large organizations. It is a set of advanced tools to design reports also to manage report access and distribution. Crystal Enterprise is similar EBIS product from Business Object, perhaps a bit more powerful and much more expensive that Microsoft "competitor". Interesting fact is that IFS is offering some version of Crystal Enterprise as part of Information Warehouse solution.

Follow-up Analytical

Analytical needs are true Business Intelligence area. Paroc has Controllers function partly working as analyst. Therefore powerful analytical tools would be very useful for them but not also for them, perhaps to all advanced report users. Analytical needs have no static form. One day you may need one form of report, next day another. Analytical tools should be very interactive and convenient to explore various analytical workspaces of available information. There number of vendors providing powerful OLAP (On Line Analytical Processing) products. From familiar to Paroc names there are Microsoft, Oracle, Hyperion and BusinessObjects (Crystal Reports).

Ad-hoc

Let's agree that Ad-hoc reports are those which are needed only once. Analytical reports may be supposed as ad-hoc reports too, but sometimes there are special information need which is not available in existing OLAP tools, and it is not worth to permanently add it there, since it is quite time consuming and not always possible. Manual data extraction with some SQL querying tools or calculation in Excel may be best quick solution.

Via Data Warehouse

Data warehouse is often seen as panacea to all reporting, data quality, integration and data archiving problems. Well,. I won't argue – it can be, but Data Warehousing is quite expensive activity – it requires really professional team and technologies. Data warehouse is build to last - to

over-stand changes of data sources like ERP, CRM, and PDM. It is very time consuming area, especially if business processes, data structure and standards are continuously changing. Certain company business intelligence culture must exist to make data warehousing effective.

Basically all needs can be driven via Data Warehouse. But would be unrealistic expectation, that DW can solve problems rooted in the limitations of ERP implementation or lack of business procedures, concept or discipline.

Reporting needs by destination category is quite clear and perhaps doesn't need a commentary:

- **Legal/Statutory**
- **Business partner**
- **Company internal**
- **Area**
- **Division**
- **PG**

Core Task No 3 - Tools evaluation and mapping

Which of available tools are to be used for each report category ?

Ok, without long introductions first please take a look to all (known for author) existing in Paroc Group reporting tools and developing environments:

		Multi Language	Rich Text Formatting	Graphics Charts	User modifiable	User interactive	Shareable
IFS	IFS Report Builder	?	?			x	x
	IFS Report Designer	x	X	X		x	x
	IFS Report Generator	?	?			x	x
	IFS QuickReports/SQL						x
	IFS QuickReports/Crystal Reports					x	x
MS Office	MS Access		x			x	x
	MS Excel		x	X	x		x
	MS Excel (OLAP Cube client)		x	X	x		x
	MS Excel (Oracle Discoverer Add-in)		x	X	x		x
	MS Excel (Report Generator Macros)		x	X	x		x
Enterprise Business Intelligence	Crystal Reports/Enterprise		x	X		x	x
	MS Reporting Services		x	X		x	x
	ScoreCards/KPI		x	X		x	
Analysis	Oracle Discoverer		x	X		x	?
	Crystal Analyzer		x	X		x	
Data Retrieval Tools	IFS IALs						
	MS SQL Server Views						
	Oracle SQL Views						
DW	IFS IW						
	Oracle Warehouse Builder						
	MS SQL/OLAP Server (Cubes)						

Tools are grouped by its type or vendor name. There are:

- **IFS** – build-in, packaged and shipped as IFS standard product
- **MS Office –** standard MS Access, MS Excel, and some Add-ins to it
- **Enterprise Business Intelligence Suite –** emerging BI market segment. EBIS is a set of advanced tools to design manage and distribute reports in large companies.
- **Analysis** – client part, interactive user tool for retrieving DW/OLAP/BI information.
- **Data Retrieval Tools** – advanced IT professional tools for extracting data from different data sources.
- **DW** – data warehouse building tools for IT professionals.

Tools visible for end users can be characterized by these properties:

- **Multi Language** – only IFS Report Designer (perhaps Report Builder too) can translate report labels and headers automatically - "on the fly", based on company or customer language parameter

- **Rich Text Formatting** - ability to make nice looking report by employing tables, different fonts and colors.
- **Graphics, Charts** - Advanced graphical visualization, pictures, photos, diagrams, charts
- **User modifiable** – says if report end-user can change report content, modify calculations, formulas, links or layout.
- **User interactive –** can user specify data range, different querying parameters in order to get needed information from the report?
- **Shareable** – can end-user (or system) easy forward or distribute report to the others?

To overview every tool individually would take too much time and space, I just will mention several – possibly important and unknown to many users.

IFS Report Designer is kind of descendant to technologically old **IFS Report Builder**. However, in the IFS, large part of standard reports is still made with Report Builder and is modifiable only by IFS programmers.

IFS Report Generator is IFS tool to construct financial reports.

IFS Quick Report is more like a navigator to launch custom reports made with SQL select query statements or Crystal Reports.

MS Access is a client PC based small database management tool. It also can be linked to larger data sources located on servers. MS Access has quite powerful data linking, sorting, grouping and filtering possibilities. It also can be used to create nice looking, user interactive reports. For small companies it is very useful BI tool. It is widely used in all Paroc producing countries, except Lithuania. Today MS Access and Crystal Reports are pushed away from UAB Paroc because of growing popularity of MS OLAP Cubes and MS SQL Views directly linked with MS Excel.

MS Excel – some love it, some hate, but one thing is for sure – even though it is quite slow, limited to 64000 rows and 240 columns, Excel will remain most popular and convenient environment of reporting. Why? Because everybody can quickly fulfill different reporting needs which are too "small" or too "complicated" to be made by IT staff as automated solution.

MS Excel (Report Generator Macros) – is a Lithuanian need. Even though Scala has Report Generator to construct financial Reports, Scala supporting company UAB Alna, has developed a Visual Basic script – Excel Macros, which fetches data from different General Ledger segments. User can easily use that data in Excel, add formulas and designing final layout of the report. It is considered as financial tool No 1 in Lithuania. It is very effective and convenient, therefore could be considered as PG need. IFS perhaps could develop same Excel add-in. But there is one danger which Paroc and IFS should consider. It is very easy to create kind of database-attacking-brutal-force with mentioned Excel Report Generator. One report sometimes includes hundreds or thousands queries against production database. This is especially real threat in one centralized production database with complicated GL accounting dimension structure - exactly what Paroc Group is going to implement. One of the first OLAP solution in Lithuania was made because of one large Report Generator report was generating 2 hours heavy workload to the database server.

Enterprise Business Intelligence Suite (EBIS) – as mention above, it is a set of advanced tools to design reports and also to manage access and distribution of designed reports. Microsoft recently have introduced very powerful product **MS Reporting Services**. It is supposed to be used as EBIS for medium and large organizations. **Crystal Enterprise** is similar EBIS product from

Business Object, perhaps a bit more powerful but much more expensive than Microsoft "competitor". Interesting fact is that IFS is offering some version of Crystal Enterprise as part of Information Warehouse solution, including also **ScoreCards/KPI** (Key Performance Indicators).

Data Retrieval and Data Warehousing Tools are not report designing tools and rather should be evaluated in long term BI strategy chapter.

Now is a time to do mapping of Paroc BI tools by Paroc countries. Here is map of Finland. Cells in blue indicate usability in Finland. Cells with "x" indicate current usability across all PG countries.

FINLAND		Operative		Follow-up			
		IFS integrated	IFS outside	Regular	Analytical	Ad-hoc	via DW
IFS	IFS Report Builder	x		x			
	IFS Report Designer	x		x			
	IFS Report Generator	x		x			
	IFS QuickReports/SQL	x		x			x
	IFS QuickReports/Crystal Reports	x		x			x
MS Office	MS Access		x	x		x	x
	MS Excel		x	x		x	x
	MS Excel (OLAP Cube client)				x		x
	MS Excel (Oracle Discoverer Add-in)				x		x
	MS Excel (Report Generator Macros)		x	x		x	
Enterprise Business Intelligence	Crystal Reports/Enterprise		x	x			x
	MS Reporting Services		x	x			x
	ScoreCards/KPI			x			x
Analysis	Oracle Discoverer				x		x
	Crystal Analyzer				x		x
Data Retrieval Tools	IFS IALs					x	
	MS SQL Server Views					x	
	Oracle SQL Views					x	
DW	IFS IW						x
	Oracle Warehouse Builder						x
	MS SQL/OLAP Server (Cubes)						x

POLAND		Operative		Follow-up			
		IFS integrated	IFS outside	Regular	Analytical	Ad-hoc	via DW
IFS	IFS Report Builder	x		x			
	IFS Report Designer	x		x			
	IFS Report Generator	x		x			
	IFS QuickReports/SQL	x		x			x
	IFS QuickReports/Crystal Reports	x		x			x
MS Office	MS Access		x	x		x	x
	MS Excel		x	x		x	x
	MS Excel (OLAP Cube client)				x		x
	MS Excel (Oracle Discoverer Add-in)				x		x
	MS Excel (Report Generator Macros)		x	x		x	
Enterprise Business Intelligence	Crystal Reports/Enterprise		x	x			x
	MS Reporting Services		x	x			x
	ScoreCards/KPI			x			x
Analysis	Oracle Discoverer				x		x
	Crystal Analyzer				x		x
Data Retrieval Tools	IFS IALs					x	
	MS SQL Server Views					x	
	Oracle SQL Views					x	
DW	IFS IW						x
	Oracle Warehouse Builder						x
	MS SQL/OLAP Server (Cubes)						x

SWEDEN		Operative		Follow-up			
		IFS integrated	IFS outside	Regular	Analytical	Ad-hoc	via DW
IFS	IFS Report Builder	x		x			
	IFS Report Designer	x		x			
	IFS Report Generator	x		x			
	IFS QuickReports/SQL	x		x			x
	IFS QuickReports/Crystal Reports	x		x			x
MS Office	MS Access		x	x			x
	MS Excel		x	x		x	x
	MS Excel (OLAP Cube client)				x		x
	MS Excel (Oracle Discoverer Add-in)				x		x
	MS Excel (Report Generator Macros)		x	x		x	
Enterprise Business Intelligence	Crystal Reports/Enterprise		x	x			x
	MS Reporting Services		x	x			x
	ScoreCards/KPI			x			x
Analysis	Oracle Discoverer				x		x
	Crystal Analyzer				x		x
Data Retrieval Tools	IFS IALs					x	
	MS SQL Server Views					x	
	Oracle SQL Views					x	
DW	IFS IW						x
	Oracle Warehouse Builder						x
	MS SQL/OLAP Server (Cubes)						x

LITHUANIA		Operative		Follow-up			
		IFS integrated	IFS outside	Regular	Analytical	Ad-hoc	via DW
IFS	IFS Report Builder	x		x			
	IFS Report Designer	x		x			
	IFS Report Generator	x		x			
	IFS QuickReports/SQL	x		x			x
	IFS QuickReports/Crystal Reports	x		x			x
MS Office	MS Access		x	x			x
	MS Excel		x	x		x	x
	MS Excel (OLAP Cube client)				x		x
	MS Excel (Oracle Discoverer Add-in)				x		x
	MS Excel (Report Generator Macros)		x	x		x	
Enterprise Business Intelligence	Crystal Reports/Enterprise		x	x			x
	MS Reporting Services		x	x			x
	ScoreCards/KPI			x			x
Analysis	Oracle Discoverer				x		x
	Crystal Analyzer				x		x
Data Retrieval Tools	IFS IALs					x	
	MS SQL Server Views					x	
	Oracle SQL Views					x	
DW	IFS IW						x
	Oracle Warehouse Builder						x
	MS SQL/OLAP Server (Cubes)						x

It is quite difficult to say which tools are better. It depends on needs and circumstances. Current experience, personal preferences does matters for all countries. Would be quite irresponsible, if I would say, that certain existing tools are not needed any more. Anyway I will mark in bold - "**X**" tools on which PG should focus further BI development.

		Operative		Follow-up			
		IFS integrated	IFS outside	Regular	Analytical	Ad-hoc	via DW
IFS	IFS Report Builder	x		x			
	IFS Report Designer	**X**		**X**			
	IFS Report Generator	**X**		**X**			
	IFS QuickReports/SQL	**X**		**X**			x
	IFS QuickReports/Crystal Reports	x		x			x
MS Office	MS Access		x	x			x
	MS Excel		x	x		**X**	**X**
	MS Excel (OLAP Cube client)				**X**		x
	MS Excel (Oracle Discoverer Add-in)				x		x
	MS Excel (Report Generator Macros)		x	x		x	
Enterprise Business Intelligence	Crystal Reports/Enterprise		x	x			x
	MS Reporting Services		x	**X**			**X**
	ScoreCards/KPI			x			X
Analysis	Oracle Discoverer				**X**		x
	Crystal Analyzer				x		x
Data Retrieval Tools	IFS IALs					**X**	x
	MS SQL Server Views					x	x
	Oracle SQL Views					x	x
DW	IFS IW						x
	Oracle Warehouse Builder						**X**
	MS SQL/OLAP Server (Cubes)						**X**

In the BI market there are a lot of excellent products which we don't use and perhaps event don't know yet. For a long term BI strategy we will need to evaluate those new possibilities. However, professional team perhaps is more important than professional tools. Expensive and powerful tools not always best choice – if you need only small part of its features and functionality it may mutate into bloated tool that are inefficient and painfully expensive to implement and maintain. While sometimes with "available for free" MS Access, creative developer can make a miracles.

Perhaps I have to do one important comment why IFS IW is not recommended platform for PG long term data warehousing. In my point of view it is not at all a solid, IFS developed platform, but rather set of 3rd part products with some minor IFS R&D add-ins packaged with IFS name. Fact that IW is based on IFS Foundations powered with old version of Oracle database not supporting Multilanguage Unicode only proves that.

IFS has some experience with data warehousing and can provide starting solution for small customers but strategically medium and large organizations should try to avoid it. Please see what recommends Timo Elliot in his white paper "Implementing Business Intelligence Standards":

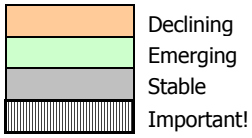
One temptation solution to the problem of BI fragmentation is to turn to the ERP vendors whose systems store much of the organization's information. Increasingly, these vendors offer "integrated BI" as additional options to their applications.

There two problems with this approach. The first is the question of data dependence. The ERP systems are inevitably linked strongly to particular data source – and for successful BI, organizations need a solution that independently access information from any of different systems….

The second problem is one of specialization. As META Group puts it, "A key reason for ERP vendors' poor track record in BI solutions is the fundamental philosophical differences between operational systems and analytical systems… BI vendors have been honing their analytics for more than a decade and ERP vendors are now playing catch-up."

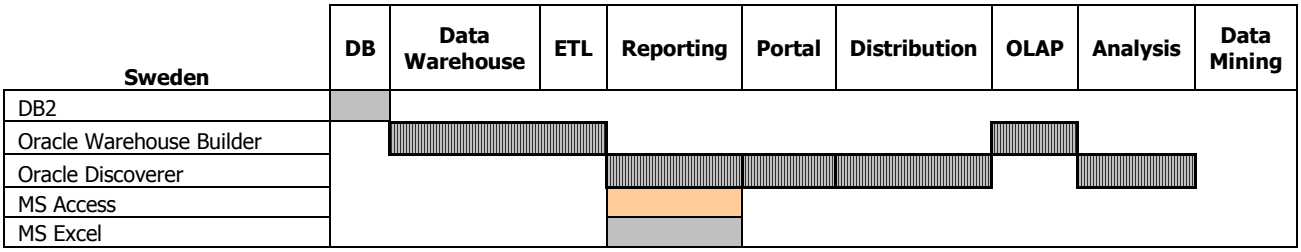
I will try to do more deep and broad possible Paroc BI strategy analysis in last chapter of this study, but if we started to talk about it, would be quite relevant to have a quick look at existing Paroc BI tools and its mapping with BI tools spectrum.

Here is legend about meaning of colors with regard to the current Paroc BI tools strategic need in the particular country:



Finland	DB	Data Warehouse	ETL	Reporting	Portal	Distribution	OLAP	Analysis	Data Mining
IFS Oracle DB									
IFS IW									
IFS IALs									
IFS Report Builder									
IFS Report Designer									
IFS Report Generator									
IFS QuickReports/SQL									
IFS QuickReports/CR									
IFS Crystal Enterprise									
ScoreCards/KPI									
MS Access									
MS Excel									

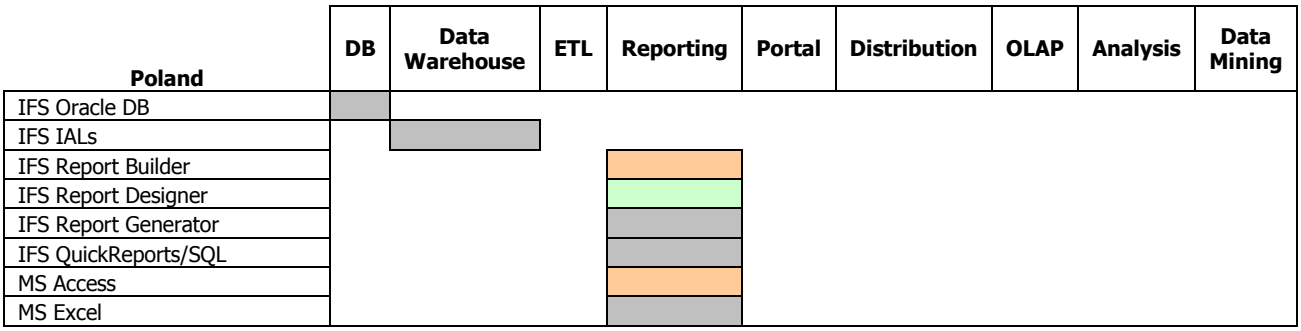
Finland has realized strategic need of data warehousing and sets remarkable expectations from **IFS IW** solution. **IFS Report Builder** is old technology going to be replaced with **IFS Report Designer. Crystal Enterprise** and **ScoreCards** were under consideration during Reporting Project (2003). These tools are part of Enterprise BI solution, but needs significant IT resources and qualification. MS Access is used quite widely in Finland, but its role in building corporate wide solution will decline. Finland has no real OLAP solution. That creates a bigger load on Finnish IT in creating lots of static reports. Interactive Analysis possibilities are very limited.



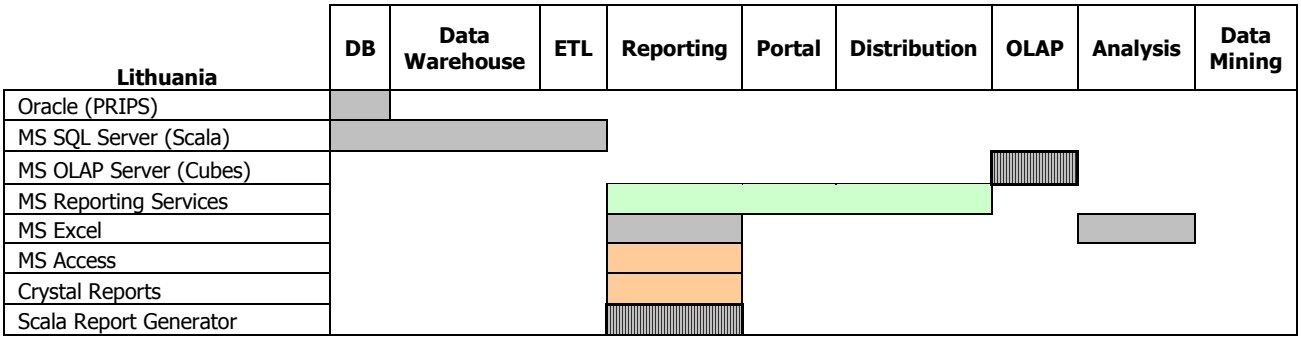
Sweden perhaps has more BI tools than Finland, unfortunately due to time constrain was impossible get information about them. However Sweden has several years experience in data warehousing in Oracle platform. Capacity Planning Tool solution was a first PG-wide BI solution. Some Lithuanian people had possibility to work with it. Idea of CPT was really magnificent; hoverer practical use of it may be summarized by front-end-users working with CPT. DIROSE practical use for Sweden is tremendous. Anyway, solution's further development is still open - all DW development and maintenance activities have no end. Sweden has customer service as a strategic priority. Thousands of PDF reports are distributed to customer automatically by DIROSE system on regular basis.

Despite that Sweden have chosen Oracle as BI platform, MS Access and MS Excel have found their niche in BI solutions.

Poland:



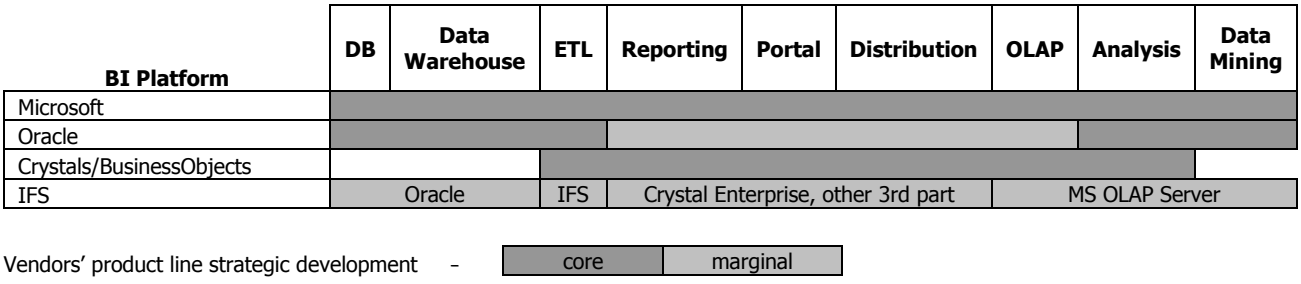
Poland have similar situation like Finland, perhaps because of same ERP. Some data warehousing and advanced report designing is done with **IFS IALs** and **MS Access**.



Lithuania has chosen Microsoft as inexpensive and efficient BI platform. Scala database is main data source for reporting and analysis. Scala data are in MS SQL Server database - MS OLAP Server was natural choice. MS OLAP is an excellent tool for creating analytical cubes, and it is part of MS SQL Server, therefore is doesn't need extra licenses. In Lithuania number OLAP cubes emerged gradually in period of 4 years without wide scale project and external consulting/costs.

In the beginning it was not so popular between business users, perhaps because of too much interactivity, and hard to comprehend multidimensional form. Information reliability was also far from 100%. But today Sales cube by its importance to Lithuania needs is equal to DIROSE in Sweden. There are also number other, very important cubes like PRIPS Cube, Stock Turnover, General Ledger and others.

Summarizing existing in Paroc BI tools here is a map of tools spectrum provided by different vendors:



Vendors' product line strategic development - core | marginal

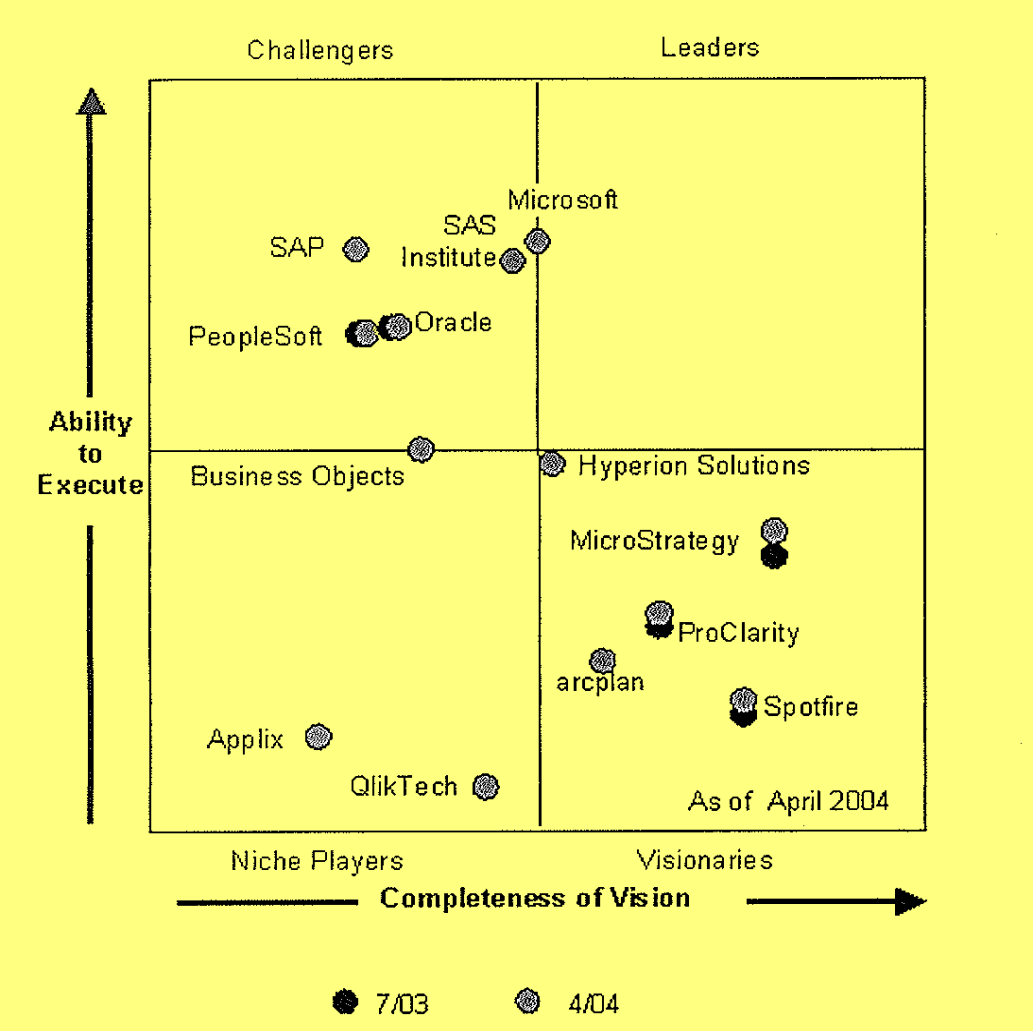
Microsoft is not very old as BI vendor, but as we know – it is very powerful player. Some 10 years ago it came to DB market, some – 5 to OLAP, and 1 year ago to EBIS market. Today Microsoft covers all range of BI product spectrum with its MS SQL Server 2000 package. MS OLAP Server today is perhaps best OLAP product in the market. Microsoft have solved OLAP "data explosion" phenomenon and achieved excellent query performance with its MOLAP storage. In year 2005 Microsoft is going to shake BI market with new Yukon power – MS SQL Server 2005 release.

Oracle is Name No 1 in DB market. It is also leader in ERP market next after SAP. Oracle has a lot of powerful BI products, but it is not as strong in EBIS and OLAP. Oracle is going to discontinue its true OLAP product Oracle Express. Oracle has announced long term partnership with Business Objects (BO) which is Europe's real leader in EBIS market. Symbiosis of those 2 platforms would make unbeatable tandem. However not all companies can afford invest to it.

Oracle and BO names are like Mercedes-Benz and BMW in automobile world, while Microsoft is more like Volkswagen.

IFS is not BI, but ERP vendor. As I've mentioned before it can offer some BI functionality "packaged" together with ERP application. Indeed IFS has own developed ETL (extract-transform-load) tool, but its functionality is very limited and it has no GUI, therefore I really doubt if it can be considered as PG DW building core tool.

For the long term perspective let's look how **Gartner Research (April 2004)** analysts have pictured current situation in BI platform market:



"The expansion of Oracle partnership and integration with Business Objects has improved its position in our BI Platforms Magic Quadrant. However, the costs of Oracle's expansion into BI platform market segment, appears to be an increasingly confusing vision for its enterprise BI suite products.

Microsoft SQL Server Analysis Services and related tools are now established as BI platform. However, the Yukon (MS SQL Server 2005) release, which is expected to have many BI-specific features, has been delayed until 1H05."

Core Task No 4 - Report development organization

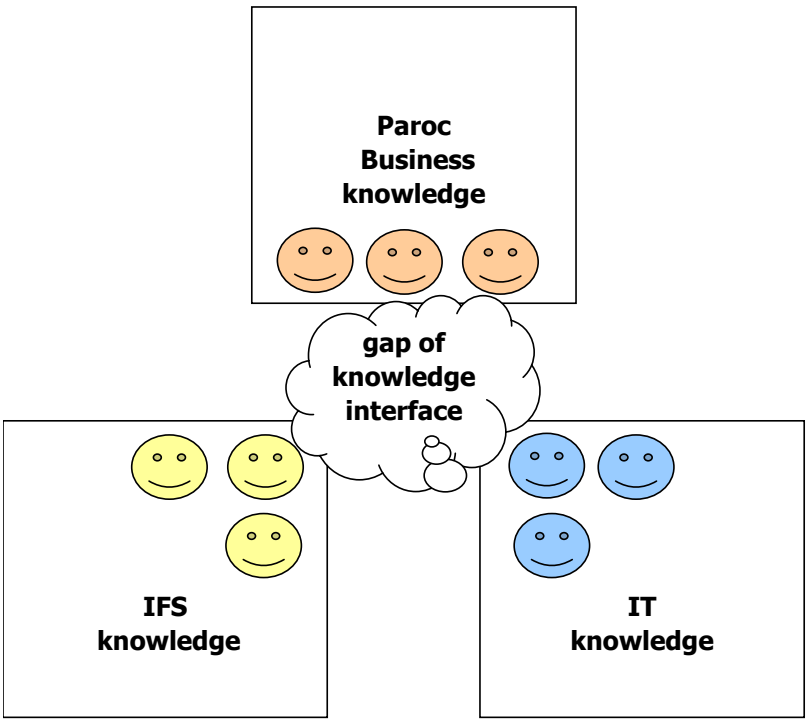
A proposal to organize report development a) during the pilot implementation phase b) for rollout phases and production use

Paroc Group common ERP system is a great opportunity, and also challenge, to unify PG report development. Having in mind, that Paroc sales companies has no own IT resources and in some countries IFS support is not available, here is clear need to have centralized IT resources providing report development for all PG countries. Perhaps IFS standard reports will cover 90% of PG countries operative reporting needs, but development of different analytical, follow-up and ad hoc reports will be constant full-time activity of PG reporting development organization.

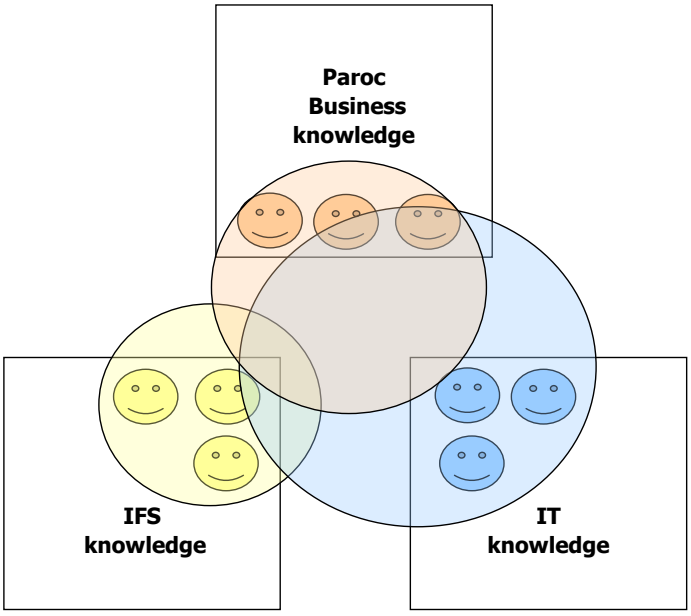
Perhaps it is more relevant to long term BI strategy chapter, but anyway it very important to stress that enterprise BI development is not ultimately IT area. Optimal use of BI requires organizational changes to ensure the proper coordination of different roles. As Gartner notes, *"A strategic approach to BI can pay handsome dividends to enterprise that exploit it properly. This should be of concern to all business and IT management because it present an opportunity to differentiate enterprise from competitors and to ensure optimal efficiency and effectiveness, and business performance, through insights into processes, customers, suppliers an the market"*

IT department can be a driving force for successful BI development on several conditions - all business processes are defined, mapped into ERP, all needed data exists, data quality and integrity are perfect. Then it is IT turn to leverage existing data and build BI solutions. But even after that business needs and processes keeps on evolving and BI solutions have to evolve as well, to meet new requirements.

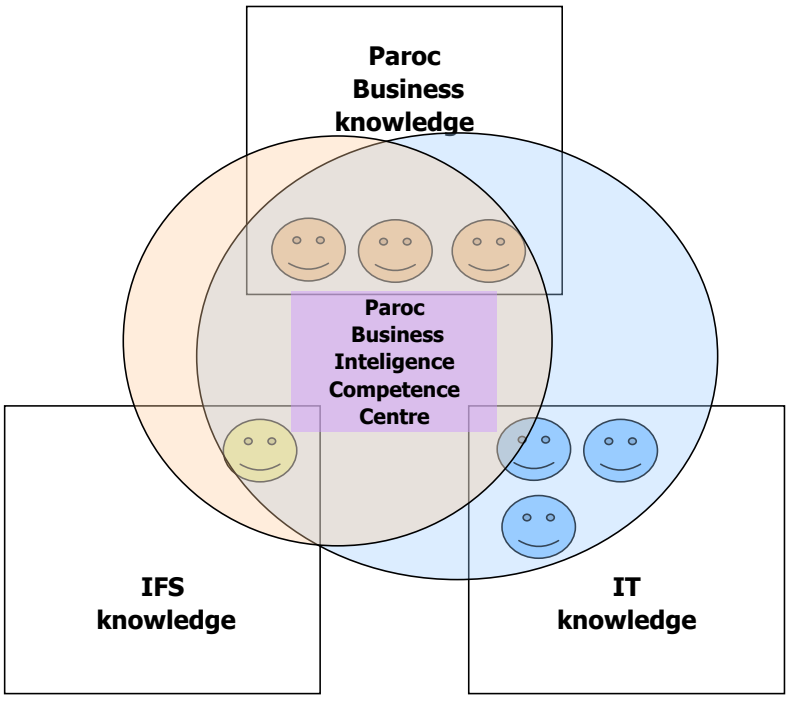
BI development faces same natural "gap of knowledge interface" also existing in IFS implementation phase. There are 3 sets of knowledge which are essential for successful solution:



In all BI projects exists knowledge and communication interface causing a bridge or "bottleneck" to reach the goal. During different workshops and trainings IT competence grows enough to cover some business and ERP system knowledge. Business people also extend their knowledge towards IT:



The long term goal is to establish BI Competence Center that embodies the business and technical best practices of the organization:



As Gartner notes, *"Organizing a formal competence centre is an important step toward achieving strategic BI. With the proper charter, organization, reporting structure and skills, the BI competence center can have a positive impact on an enterprise by instilling best-practice principles into all BI endeavors."*

Paroc is going to have ERP Competence Center. Having in mind that ERP and BI are very interrelated areas and Paroc is not very large organization, perhaps there will be one common competence centre coordinating support and development of ERP and BI.

Now, let's try to see what are the PG internal IT resources, available for BI development. Historically happened so, that Paroc Group has no own Data Center and sufficient IT development resources. Parcomp, big former Partek's IT department, was remised to largest Nordic IT service provider TietoEnator. Today main Paroc IT functions are outsourced to external service providers, all larger IT development is outsourced too.

However in Paroc Group producing countries there are some internal IT resources working with maintenance of current operational DB, also with data querying and BI tools development.

Country	Resources	Names
Finland	5	Arja, Kristian, Risto, Aarne, Mikko(?), Suvi(?)
Sweden	4	Laars, Agne, Mats, Åke
Poland	0.5+0.5	Tomasz, Tomek
Lithuania	0.5	Gedas

Even though not all names has long-term employment contracts and also not equally experienced in database and BI world, 10 people team is quite big potential. Hopefully, when Paroc ERP project is over and number of old operational systems reduces, these people will be able to concentrate more on BI development and data warehousing.

To make assessment of current Paroc IT BI development experience and also tools evaluation I've made table and forwarded to known to me colleagues:

	Experience			
DB/DW/BI Product	from	avg. hours/week	Experience, years	appreciation
MS SQL	1999	8	1.1	9
MS OLAP	2000	4	0.5	9
MS DTS	1999	2	0.3	6
MS Reporting Services	2004	0.1	0.0	8
MS Access	1997	2	0.4	4
MS Excel	1993	6	1.7	10
Crystal Reports	1998	1	0.2	5
Crystal Analyzer	2004	0.1	0.0	3
IFS Report Designer	2004	0.1	0.0	5
Total	1993	**23.3**	**4.1**	

Unfortunately I've received too little response to make any summary possible. May be it is too personal information, may be friends are afraid of something, don't know – it's their right to keep it concealed. But for "Questionnaire - IT troubles with reporting development" there were enough responses to put in common table:

	Response 1	Response 2	Response 3	Response 4	Response 5
Complicated structure of data sources ?	7	5	5	5	5
Poor data quality and data integrity ?	10 + even "none exsisting" data that should be reported	9	6	5	7
Unclear business logic/procedures ?	9 unfortunately in too many cases this is the case	5	6	8	8
Lack of business users able to define their needs ?	9 pls see also Q2	8	6	6	7
Poor support from ERP or BI solution/product vendor ?	5	6	5	5	5
Too many overlapping reports ?	5	7	3	4	3
Too much time needed to maintain existing reports ?	5 this depends by function	9	7	4	5
What is balance between new report developing and maintenance/adjusting/updating old ones ?	The balance is poor	1:5		1:1	1:2
Too much time needed to track down reasons why report figures seems incorrect ?	9	8	8	7	6
Too much time needed to explain/educate users about your reports ?	7	5	5	5	5
How much time (min/month) you spend on running (extracting data) reports ?	0 min	90 min	300 min	0 min	0 min
How much time (min/month) you spend on distributing/push reports to end-users ?	0 min	300 min	10 min	0 min	0 min
Which reports are most prone to error/mismatch ?	Sales Profitability, Inventory values, Consumptions, etc.	Sales Profitability, Bonus calculations		Sales Profitability	Sales Profitability
Any other problems ? What would you like to change in your work ?					

10 = 100% true

good	normal	bad

To the last question - **"**Any other problems? What would you like to change in your work?" I've received two valuable answers, describing well current PG BI situation:

"IT spends too much time on receiving reporting needs and designing simple reports. This should be done in the departments that have the reporting need. IT should only handle complex data integrity questions and if some new information or new information sources needs to be made available. In other reporting question they should only have a consulting role".

"The users should also have more realistic understanding of what can be produced from e.g. "none existing data" and what kind of solutions IT can provide if requirements/processes are not clear (or have too many exceptions) to the users themselves"

Ok, let's come back to main subject Core Task No 4 - Report development organization**.** It is a **proposal to organize report development a) during the pilot implementation phase and b) for rollout phases and production use**.

It is very critical question. Here are huge pressure on business and IT to survive during migration to new ERP. It is especially huge concern for 11 countries, to which IFS is totally new system. Existing reporting tools, solutions and system knowledge will be useless. Unfortunately there are no magic remedies how to "jump" to new ERP world. It is rather a marathon.

What was acquired in current ERP environment during ten years or more, can not be packaged and migrated. This applies to lots of ERP customizations, integrations, internal and external reporting tools and also ERP system knowledge. Hopefully good experience and some fundamental knowledge will be transferred to new ERP.

There are 3 reasons why during ERP implementation/rollout period Enterprise BI development is very little possible.

- **Principa**l - DW and BI is linked with but not part of ERP functionality.
- **Resources** - there will be urgent operative ERP problems to solve for IT (e.g. migration, integrations, infrastructure, support, problem communication, and so on). Data warehousing, automation of reporting and BI development is priority No 2.
- **Data Source** - Group level data warehouse can not be build before all countries' data are "in place" - one data source – IFS DB.

Therefore BI and DW is rather post-project than sub-project of ERP. However, common ERP is a precondition and foundation for BI development. Everybody should be concerned about proper ERP set-up, data quality and integrity. If needed business processes are not mapped to IFS data structures, then BI will not be able to recover missing information holes. It is often mistreated that missing data or poor data quality is reporting problem. No, it should be referred as ERP or business process problem.

Would be very good to manage and coordinate existing limited IT resources, so that during every country's rollout phase, all PG IT expertise would give support to that country. Latvia – first sales country and Lithuania first (IFS-new) producing country will need most of that support. Sweden is biggest "load" to be carried out, but hopefully all the other countries experience and support will help a lot.

Then, if PG ERP project is successfully implemented and all urgent local application reintegration questions are solved, would be right time to start build BI skyscrapers. It is hard to say yet, what would be the best way of organizing common PG pool of resources. Or is it efficient and practical that one multi-national team would serve all countries? I believe that would be right approach, it would filter-out and unify all countries and divisions reporting needs and habits. But that perhaps would be not very welcome by local business units, expecting operative local IT support. Also there are language problem – there are a lot of reports in local languages. And there are also some country specific reports. That means that specialization and perhaps responsibility map by country will be inevitable. Specialization by BI tools spectrum, e.g. DW, OLAP, report design, portal, dashboards, and data-mining also will be inevitable.

However, for most critical IFS operative print-out needs, there is Paroc international Reporting Team lead by Arja Konttinen. Project group is working with common PG invoice, order confirmation, picking list, delivery note, reminders and other operative print-outs to business partners. Goal is to have one common layout for all Paroc companies. Dynamic labels/header translations according destination company/partner language parameter is a key issue. If translation works fine, perhaps there is no need to have big team working with IFS Report Designer. Would be safer, if only 1-2 persons make future modification and customizations of common PG layouts. There should be some formal procedure to assure that one company needs does not conflict with common PG layout. Could be that this will be too complicated and impractical. Local companies will certainly need some flexibility and independence. If so, countries "not fitting" in common layout, would need to have own designer, familiar with local language and able to work Report Designer.

Complementary Task No 1

Assessment of the role of the current Oracle based business intelligence and reporting solution in Sweden and a proposal of what of it to keep and what to rewrite with above mentioned tools.

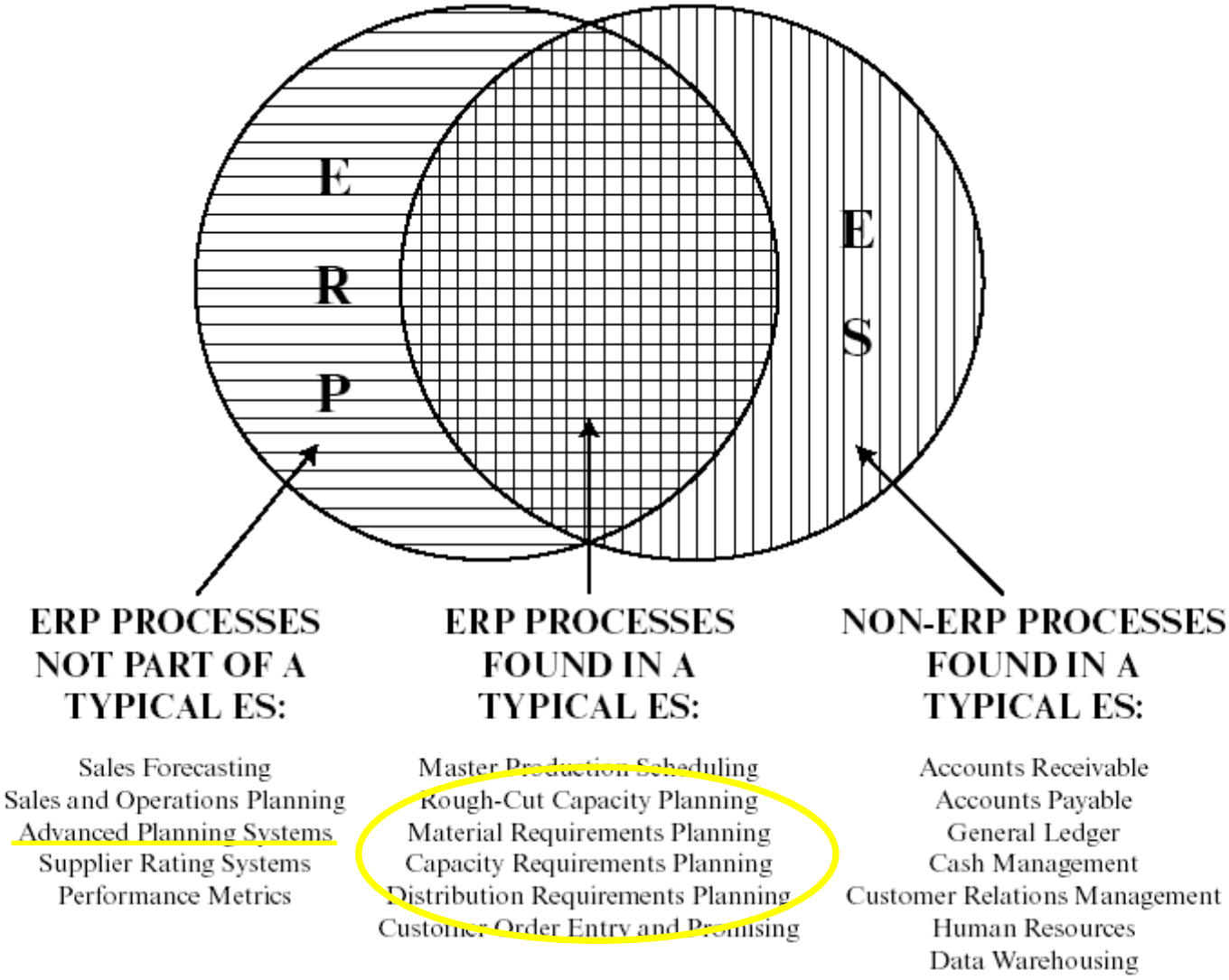
As mentioned in "Tools evaluation and mapping" chapter Sweden has several years experience in data warehousing in Oracle platform. DIROSE, CPT, and TIPPIS are 3 Swedish BI applications.

DIROSE perhaps is most valuable solution. It provides all information needed for Sales follow-up, deviation from budget and profitability analysis. Complicated-to-calculate Freight and Bonus information is available in DIROSE analytical workspace. Sweden has customer service as a strategic priority. Thousands of PDF reports are distributed to customer automatically by DIROSE system on regular basis. Anyway, solution's further development is still open – usually DW development and maintenance activities are a constant need. One of the considerable improvements is analytical query performance. Oracle Discoverer is based on ROLAP storage technology which does not stores pre-calculated values. Aggregates are generated "on-the-fly" from the Data Warehouse, which must be designed properly and optimized for querying speed. Good news is that Oracle 10g version has some database build-in aggregation functionality like Materialized Views. This allows realizing HOLAP (Hybrid OLAP) storage and significantly improving performance.

Main DIROSE data sources are ROLF and MOVEX – systems which will be replaced by new ERP. It means that 50-90% of DIROSE will have to be redesigned. Practically it is all ETL (extract-transform-load) scripts and routines. Change is so huge that practically equal to design of new system. If Paroc going to consolidate all countries Sales information in one analytical workspace or hyper cube, new DIROSE should be part of it, model of it, or replaced by it.

Capacity Planning Tool (CPT) solution was a first PG-wide DW solution initiated, coordinated and implemented from Sweden. Idea of CPT was really magnificent. Hoverer practical use of it may be summarized better by front-end-users working with CPT. CPT future is under question of IFS driven functionality. The point is that CPT is core function of typical ERP system (please look to the picture on the next page). If IFS implemented fully and correctly, external CPT should not be needed any more as operational capacity planning tool. May be it should be seen more as Advanced Planning system then.

TIPPIS is TI production application, similar to Base production application PRIPS. Perhaps it is not as critical as DIROSE, and not so global as CPT. It is initiated and coordinated by Sweden and intended to implement in all TI producing countries. TIPPIS is standing quite aside from "ERP-train" and therefore will not be affected by first wave of BI development.



A key factor for rewriting Swedish solutions will be a common, Paroc Group chosen, DW and BI platform.

In favor to Oracle platform (and Swedish expectation), IFS is driven by Oracle database. That makes ETL and DW building in Oracle platform preferred choice. However it also can be done with other vendors' tools. Oracle is neither most advanced, nor most expensive, nor most inexpensive choice. Perhaps more important is what license (e.g. Oracle Warehouse Builder, Oracle Developer Suite), and what skills owns Paroc in Oracle platform. Sweden is perhaps the only and major owner.

Bad factor for Oracle is that Sweden is the last country in the ERP rollout schedule. Perhaps other countries will not wait and will start build own BI solutions with available capital, experience and

resources. E.g. Lithuania will try to rewrite Sales and perhaps other cubes as soon as possible in year 2006. MS OLAP Server is at least temporary platform for that.

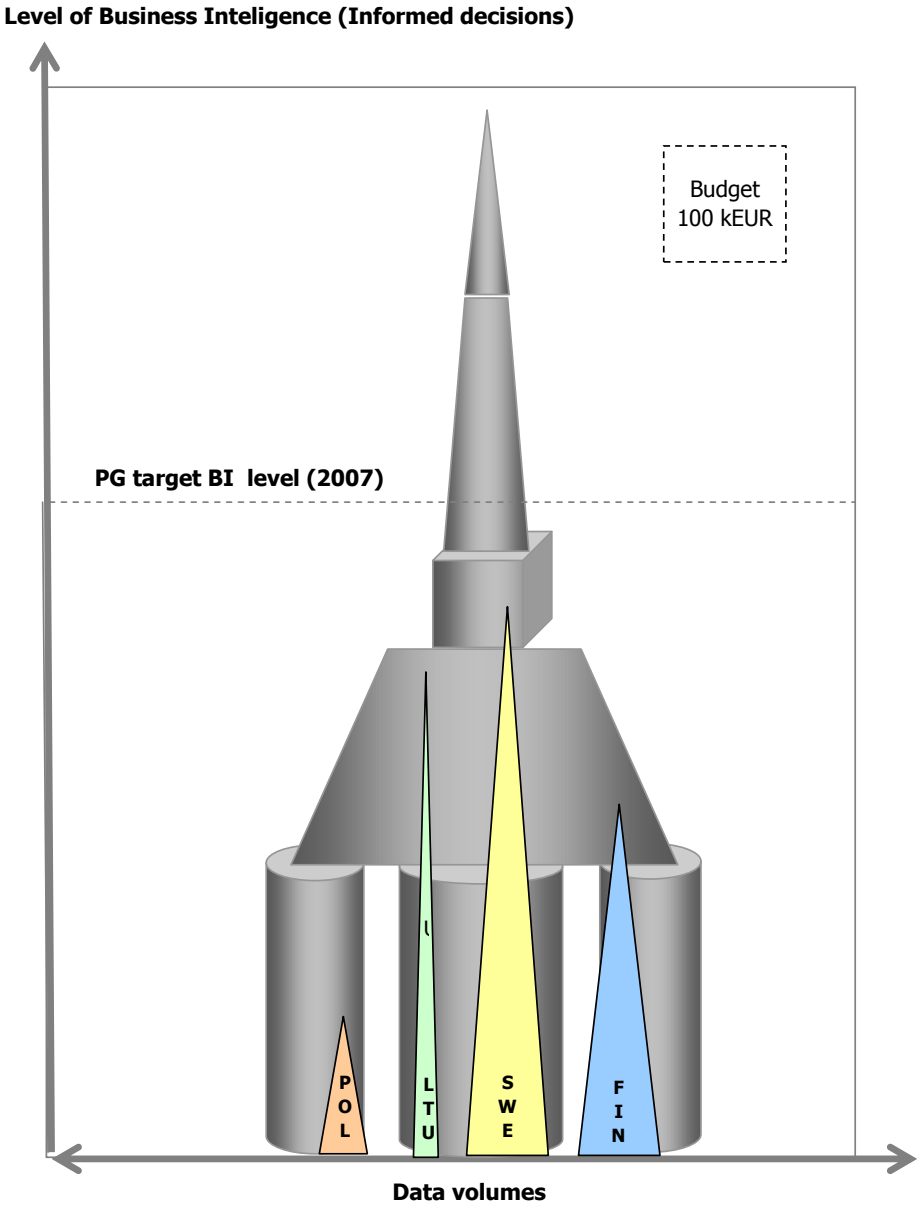
Single vendor BI platform, is important, but perhaps not mandatory and not the most important factor for successful development. In practice some mixed BI product portfolio is quite often. Having low budget, some non-traditional combinations may be very effective solutions. Could be so, that presumably Paroc Group owned Oracle Developer Suite, MS OLAP Server and Crystal Enterprise fits nicely in one BI portfolio. If so, perhaps Sweden could focus on DW, Finland/Poland - on Crystal Enterprise and Lithuania - on OLAP. That looks to me quite non-traditional, but balanced scenario, well compromising within existing Paroc licenses, experience and preferences. But once again we should make thorough audit of currently Paroc owned licenses and skills.

Complementary Task No 2

A long term data warehouse roadmap and implementation plan from 3Q2005 onwards can be proposed including ERP interface, DW database, OLAP tools, reporting tools and report publishing tools.

Description of Complementary tasks No 2 above, very exactly orders sequence of long term BI activities. However, it is quite difficult to set starting and ending points of every those activities. More or less, to some extend all producing countries already doing some BI development. Redesign of existing tools and consolidation to one PG BI solution will start in different times, basically right after each country ERP rollout. But more difficult is to say when it ends, or to say truth – it is very easy – data warehousing and BI development never ends.

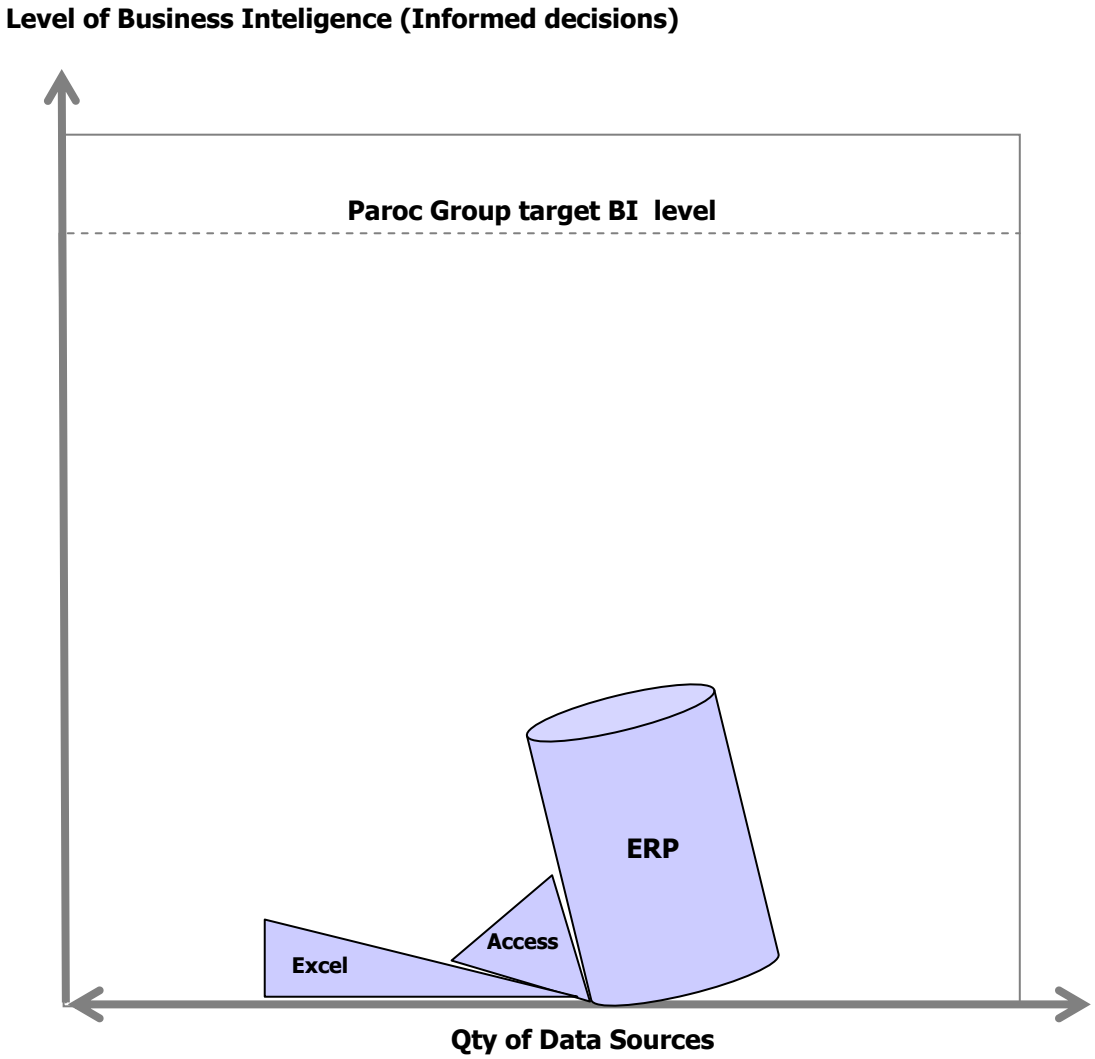
Here is rather symbolic PG BI skyscraper and rough shapes of producing countries BI solutions:



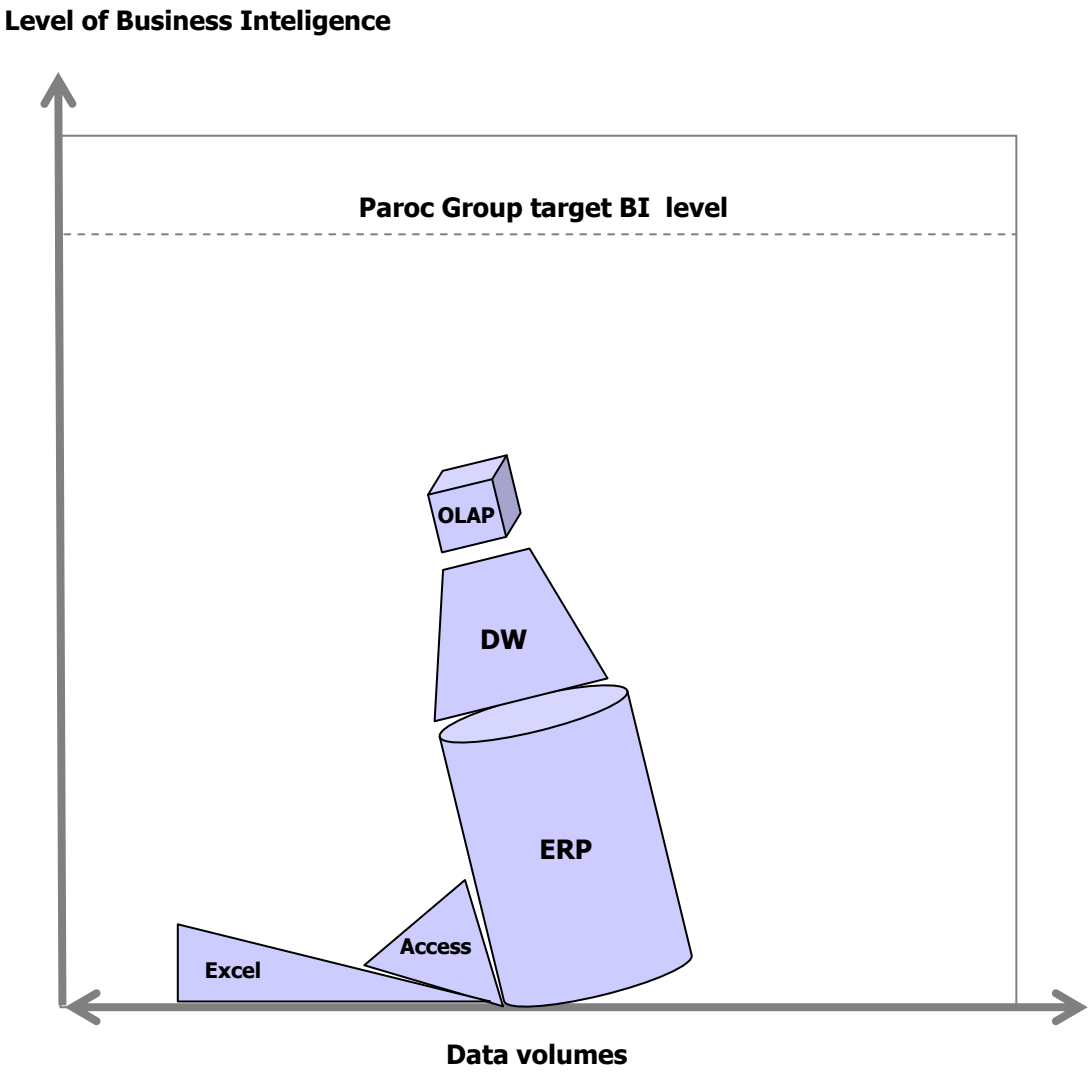
Please note that budgeting is very proportional to data volumes and level (quality, innovativeness) of BI solutions. Geometrical area of shapes illustrated means money to invest:

BI Budget = target BI level x data volumes x data sources

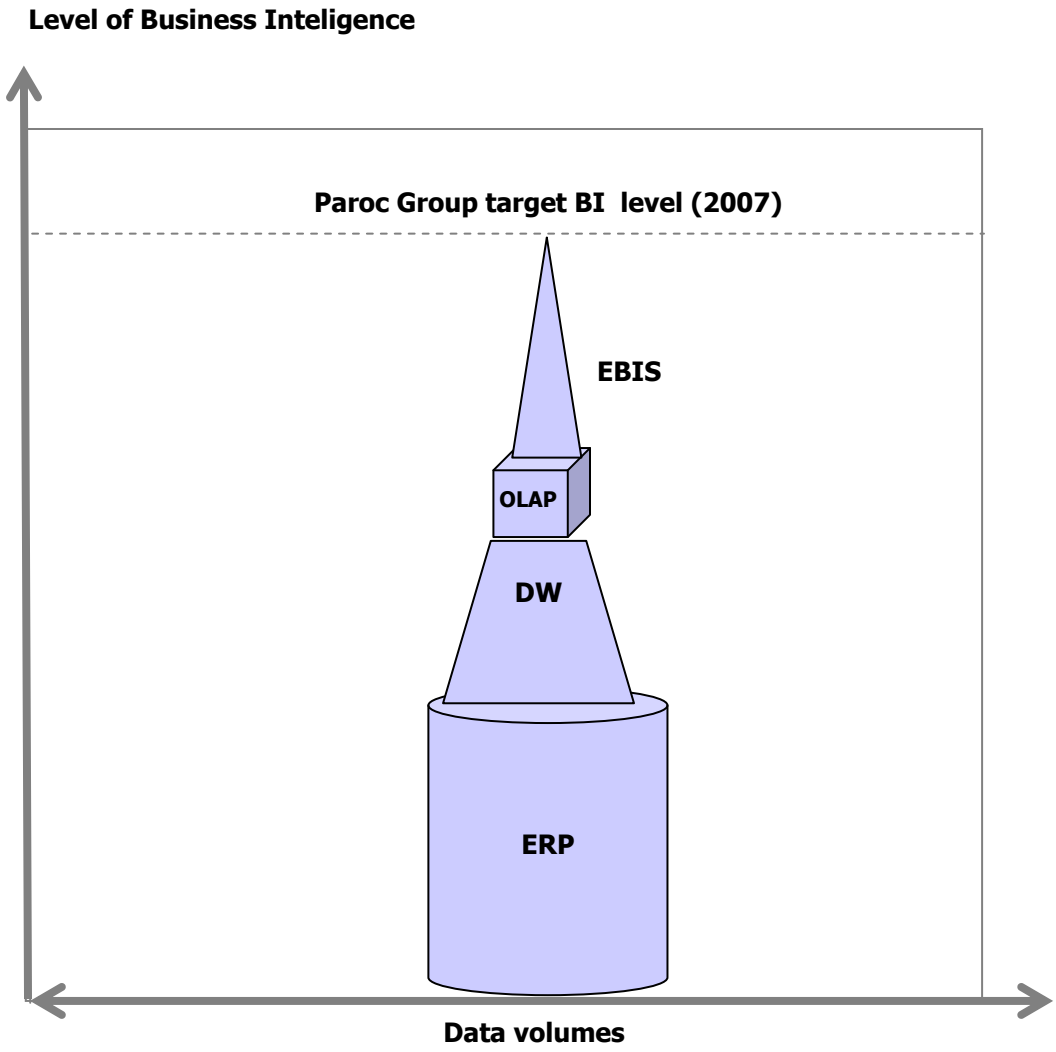
Now let's go to the foundations of BI. ERP is a main data source for data warehousing. Here is a picture illustrating a situation when ERP is implemented not in the best way or data quality is poor:



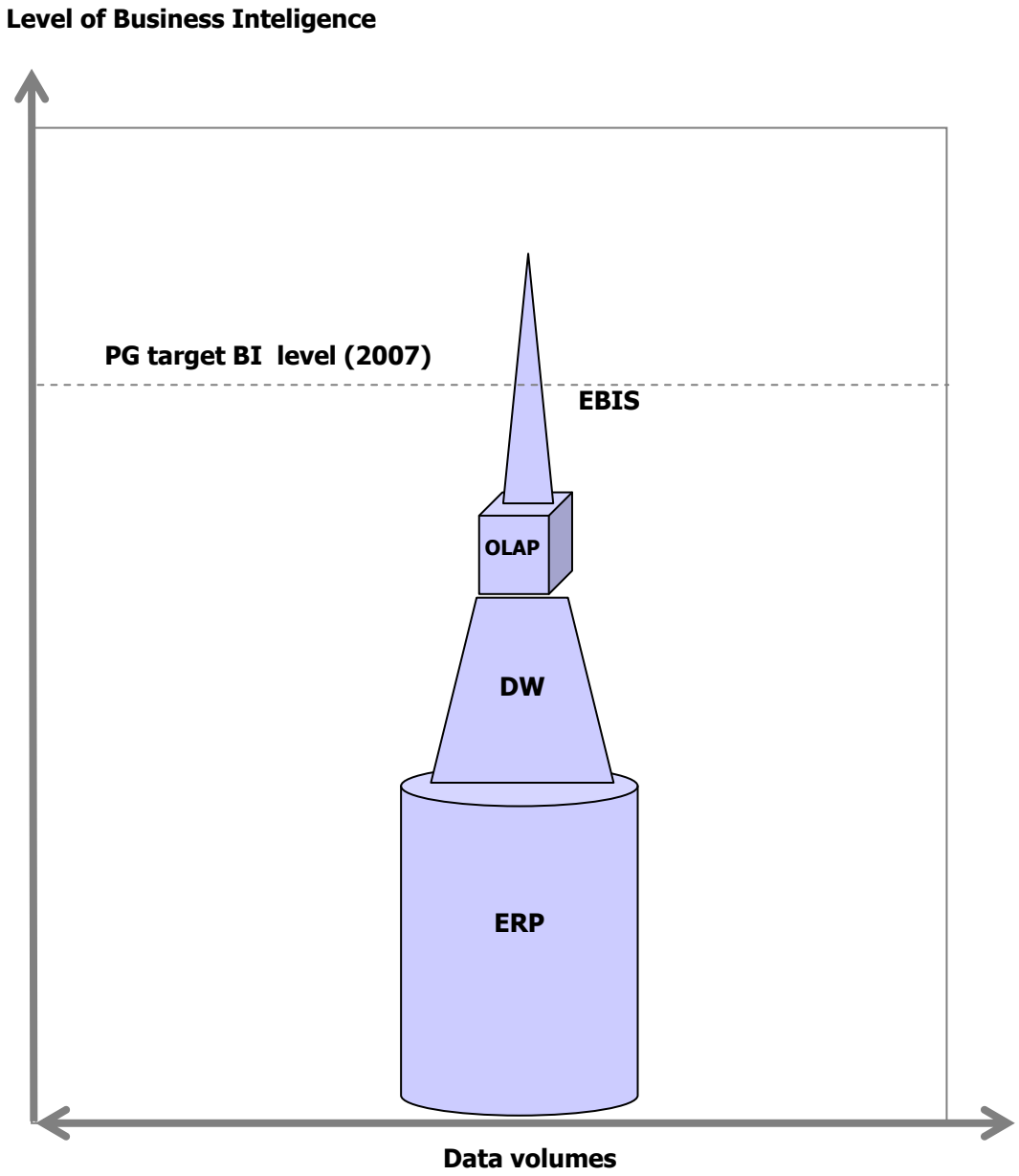
MS Access is a quite powerful report designing tool. But most useful MS Access feature is that it is at the same time a small RDBMS (database). It can be used as support to missing or bad structure data in the ERP. MS Excel works well with MS Access and is most popular report designing environment for wide range of advanced users.



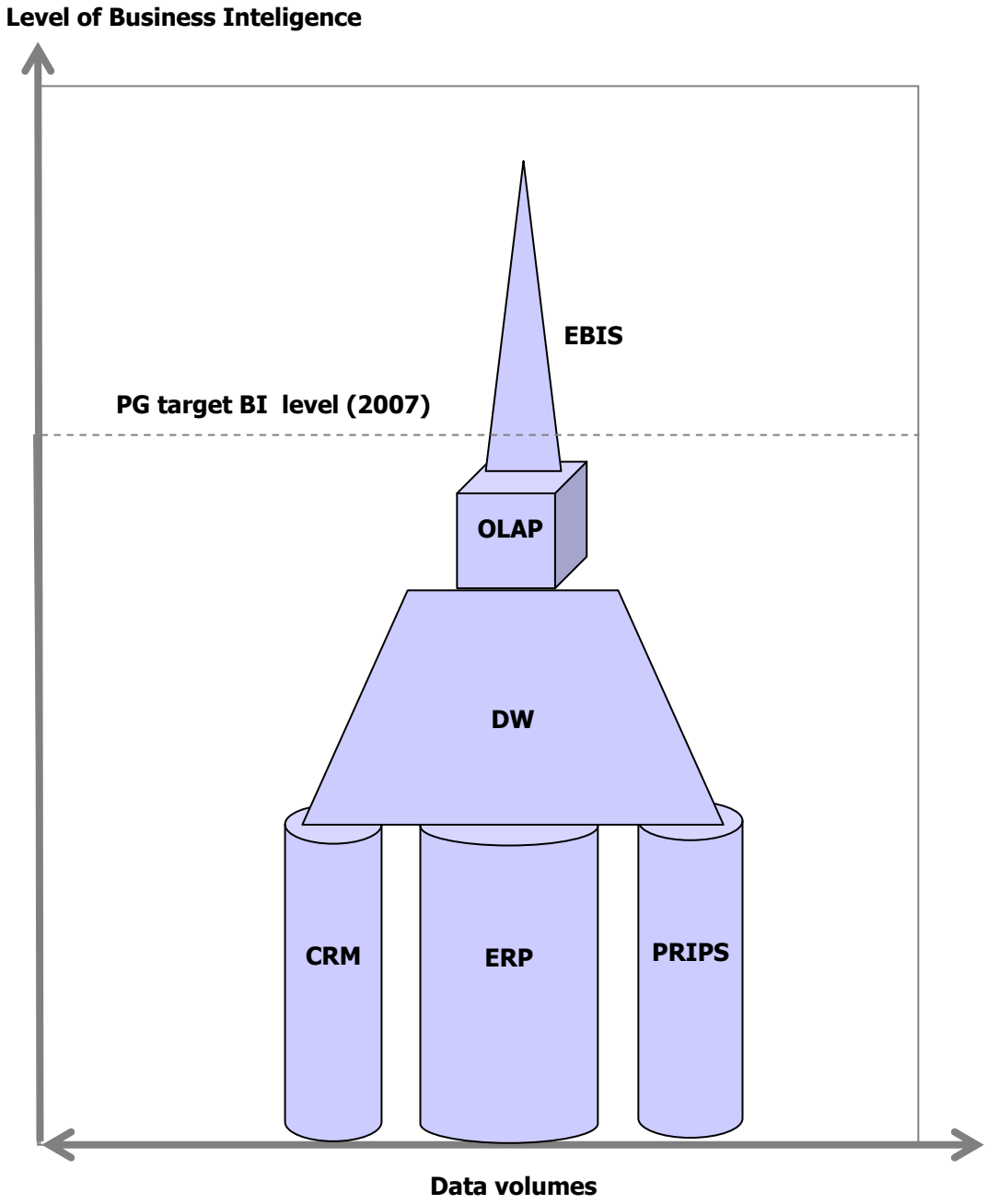
Building of enterprise Data Warehouse and OLAP requires more professional skills and funding. It can greatly improve company BI level. However it needs solid and stable foundations – well implemented ERP.



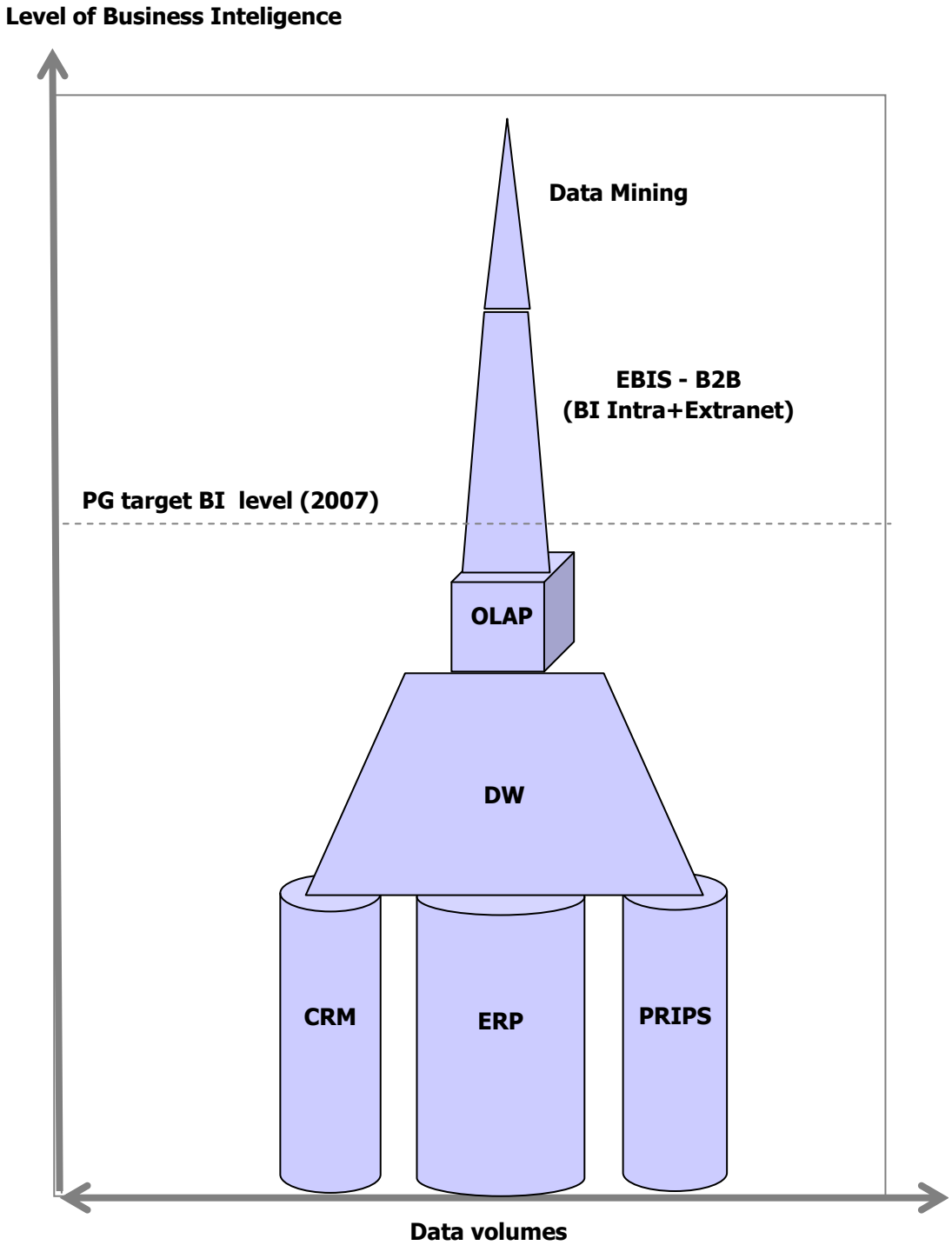
Here is picture of possibly good target for Paroc BI development. Presumably in the year 2006 common PG ERP is implemented excellent - data quality is good and data assets are rich. PG team works hard on DW, OLAP and redesigns main reports with chosen Enterprise BI Suite. It means also better report management – distribution and publishing. Common reporting repository and portal are in use. May be even some basic dashboards for top management daily operative follow needs. This is what I see as a good target for year 2007.



With time, Paroc BI needs grows, information culture too, more data available in the ERP, new key performance indicators (KPI) are identified. Value and level of BI grows on the base of existing tools.



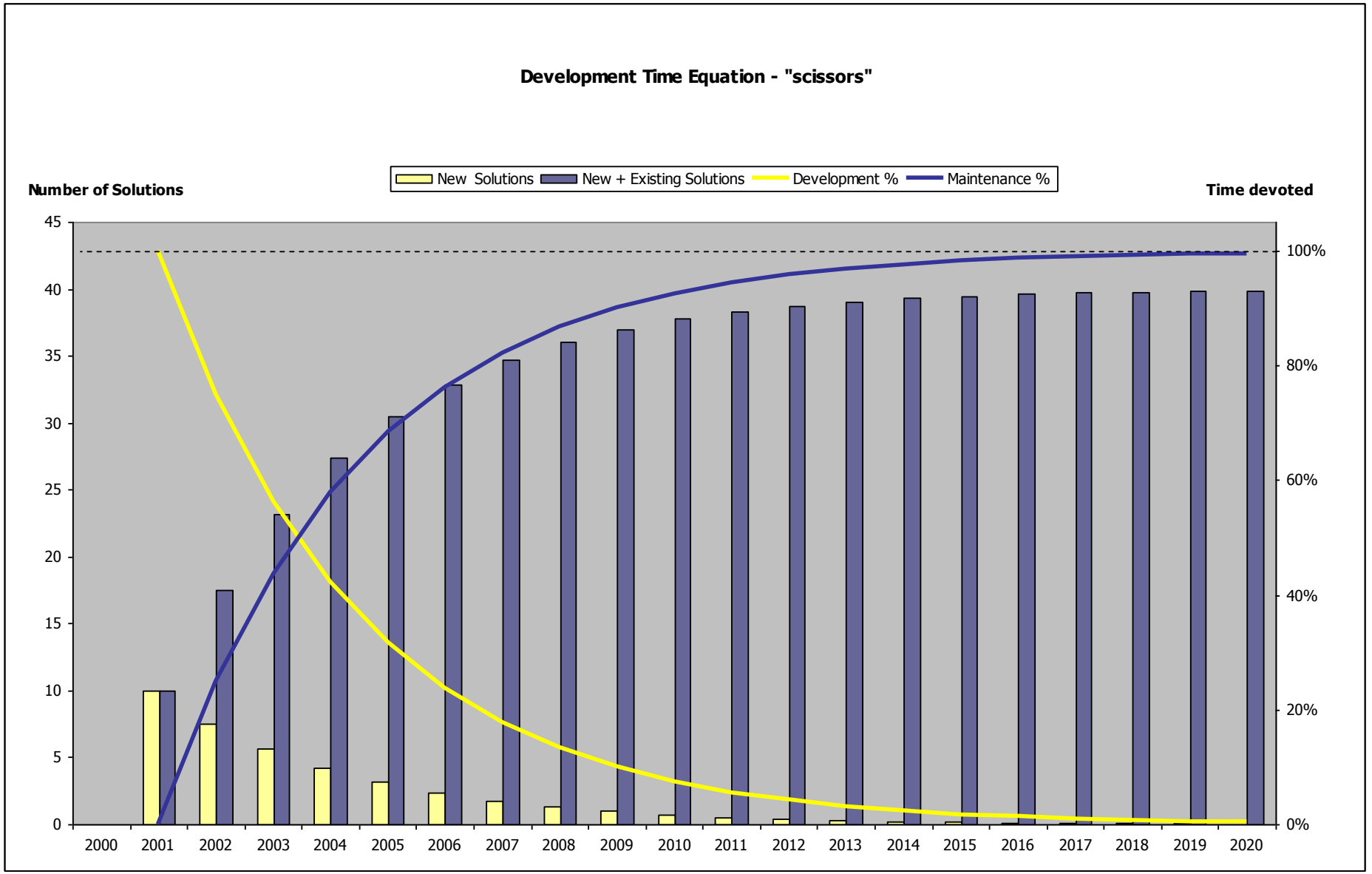
What next ? More data sources and OLTP systems linked to DW. More information is available from BI tools. In conjunction of ERP, PRIPS and CRM new sophisticated KPI may derive.



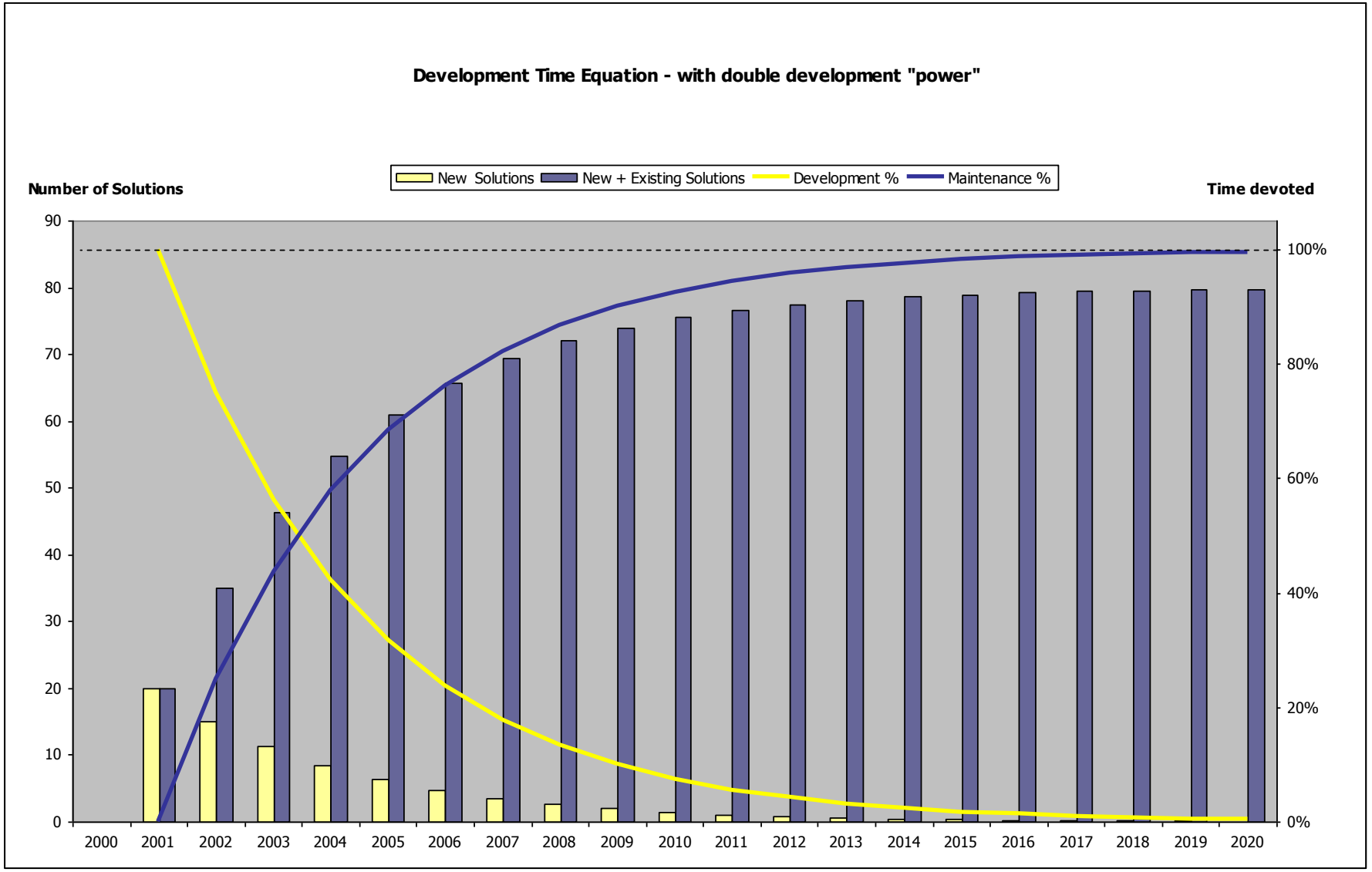
And the last picture in this long term vision is B2B BI and Data Mining. Information assets so rich and reliable that sophisticated Data Mining applications bring new value. Information access is well managed and shared with business partners.

Ok, now from dreams let's back to reality. Assume we get needed funding, and with time gain enough technical skills. What are the needs of time resources or man hours ? As I've mentioned before – there more reports and solutions the more time needed to administrate and maintain it. Many IT companies charge 25% maintenance fee from license value or solution implemented. I believe it would be a true ratio for internal BI development as well. Based on that I've made a model assuming that for BI team of N persons is capable to produce 10 particular solutions. Next year it has to spend 25% percent of their time to maintain it, but team is still able to produce 7.5 solutions. After 5 years 68% of time is spent on maintenance and only 32% on new solutions design. In period of 10 years team would develop 38 solutions and 92% of time would spend on administration and maintenance. It means that development of new solutions is very limited. And after 20 years team would be 100% busy with maintenance of 40 solutions. What if 40 solutions is not enough, or 20 years of waiting time is presumably not acceptable ?

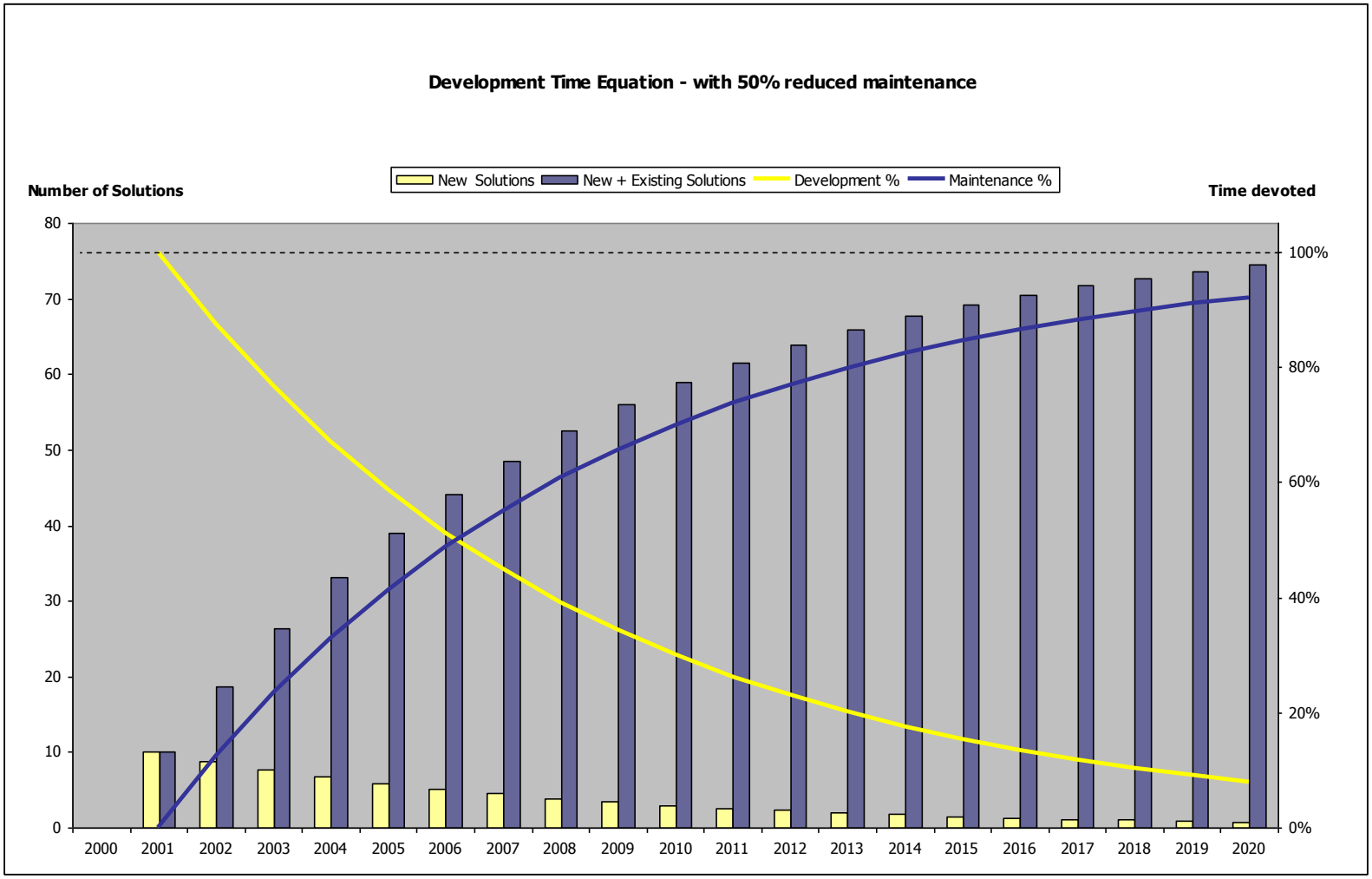
Year	New Solutions	New + Existing Solutions	Development %	Maintenance %
2000				
2001	10.0	10.0	100%	0%
2002	7.5	17.5	75%	25%
2003	5.6	23.1	56%	44%
2004	4.2	27.3	42%	58%
2005	3.2	30.5	32%	68%
2006	2.4	32.9	24%	76%
2007	1.8	34.7	18%	82%
2008	1.3	36.0	13%	87%
2009	1.0	37.0	10%	90%
2010	0.8	37.7	8%	92%
2011	0.6	38.3	6%	94%
2012	0.4	38.7	4%	96%
2013	0.3	39.0	3%	97%
2014	0.2	39.3	2%	98%
2015	0.2	39.5	2%	98%
2016	0.1	39.6	1%	99%
2017	0.1	39.7	1%	99%
2018	0.1	39.8	1%	99%
2019	0.1	39.8	1%	99%
2020	0.0	39.9	0%	100%


Development Time Equation - "scissors"
New Solutions
New + Existing Solutions
Development %
Maintenance %
Number of Solutions
Time devoted
45
40
35
30
25
20
15
10
5
0
100%
80%
60%
40%
20%
0%
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020

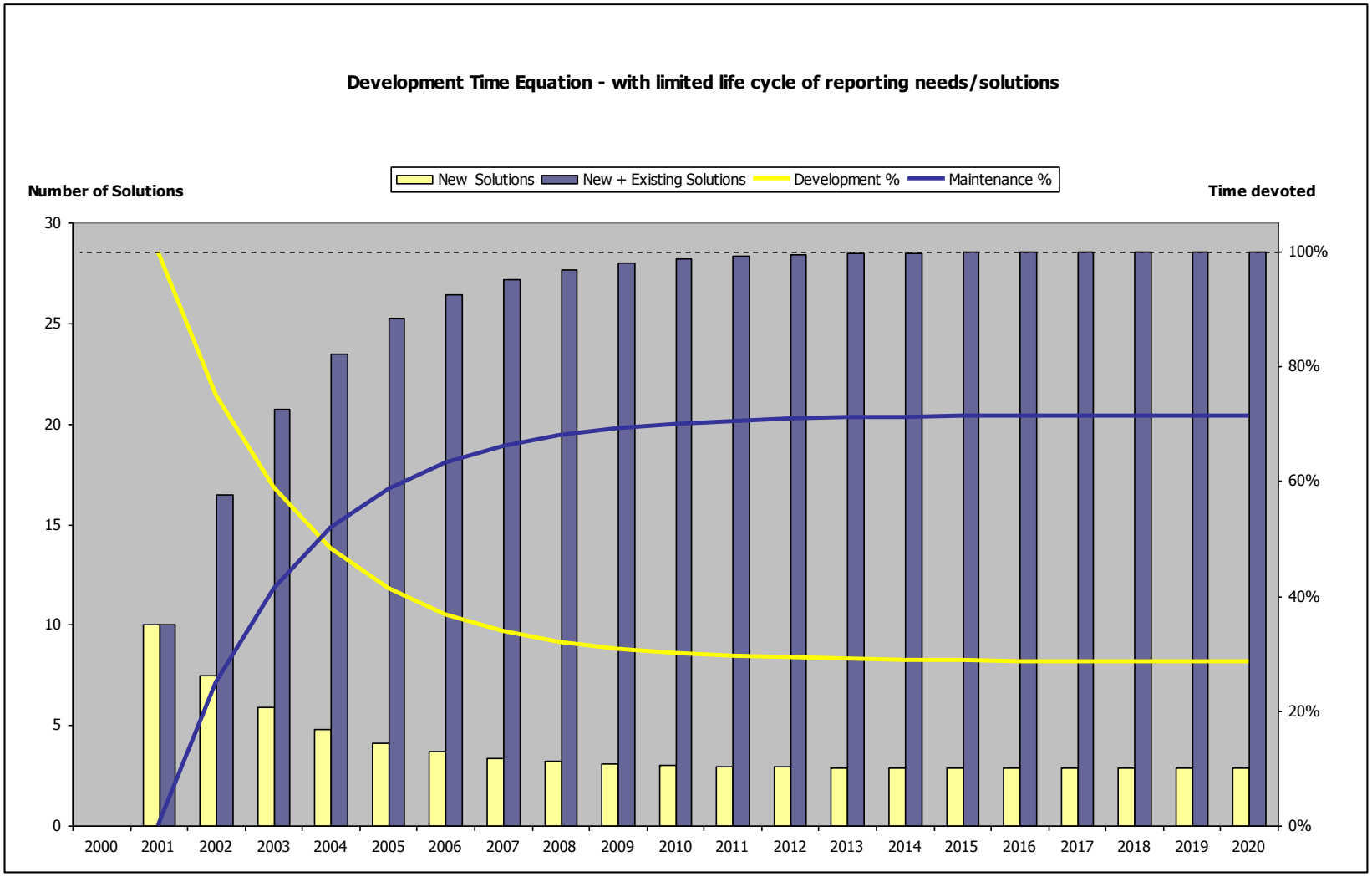
Natural way to accelerate development would be increase of development power by sourcing new developers. With double resources, same 40 solutions would be worked out in 3 years. After 20 years team would "end" with 80 solutions



Another way of improving development productivity would be spend less time with maintenance. It is very unlikely, that would be possible, to reduce yearly maintenance ratio from 25 % to 12.5%. Business processes should be very stable, data structures fixed, data sources unchanged. That's not likely in these times of restructuring and globalization. Business needs agility and fast changing. They also expect good support and service level from IT. Anyway, in very long term perspective twice reduction of maintenance would allow to reach and stick with same number of solutions like in double developing power team employed.

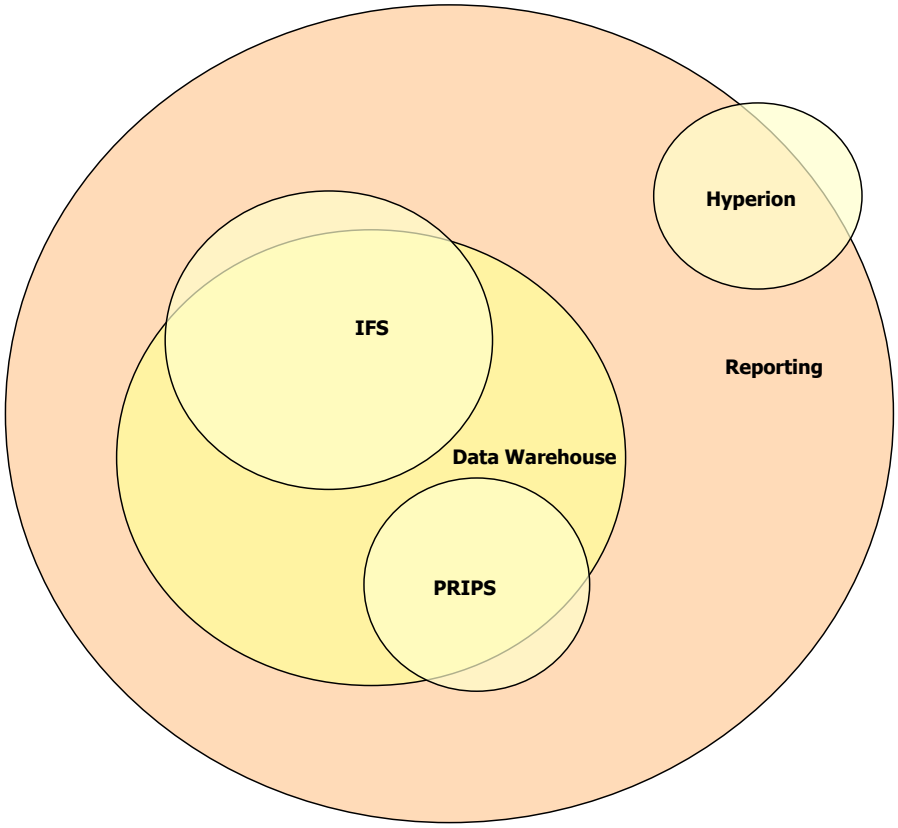


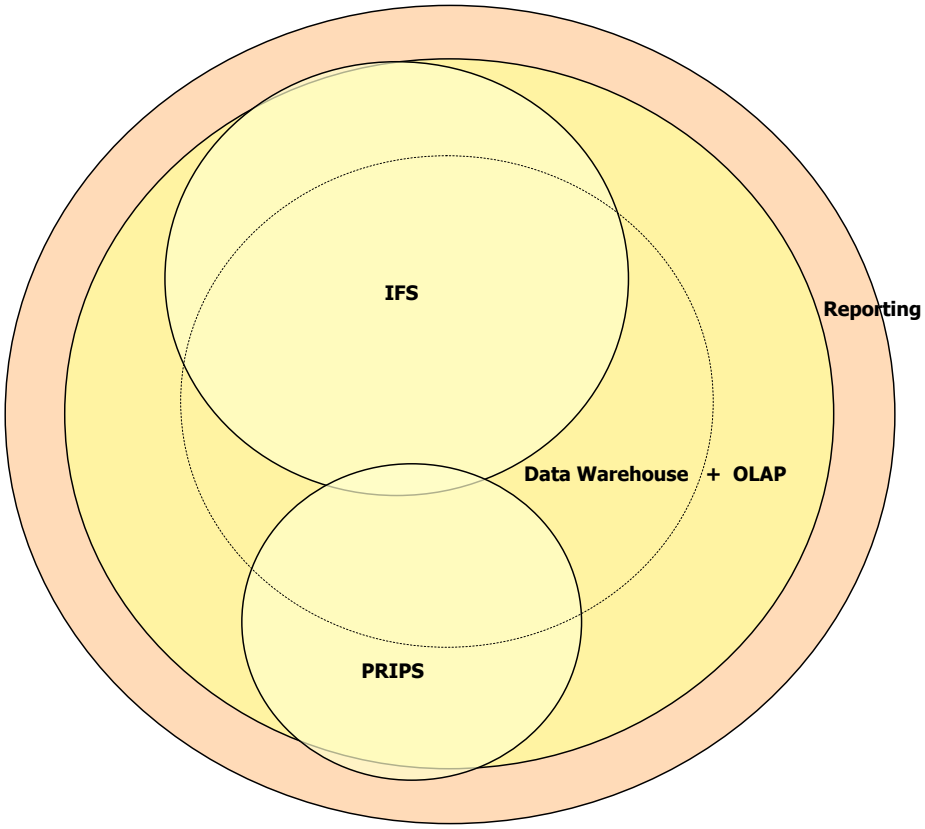
To have more realistic model, one more factor have to be investigated. It is life cycle of reporting need or solution. Assume every year business does audit of their needs and notes that 10 % of existing reports are not needed any more. Though it is very unlikely, knowing natural human desire to have, but regular "stop doing" or "stop having" cut-off is very effective. And it is the only way to have good development/maintenance time balance. May be having 28 solutions and possibility quickly meet new reporting needs is better strategy than getting stuck in maintenance of 40 old solutions.



Summarizing development resources problem, we should always think carefully what could improve productivity. Double development power not always is a solution. In the end it will turn against developers as burdening supporting activity. Reduction of maintenance or more effective administration, as well as regular getting rid of old reporting needs, may be the only way to keep company's developing potential high.

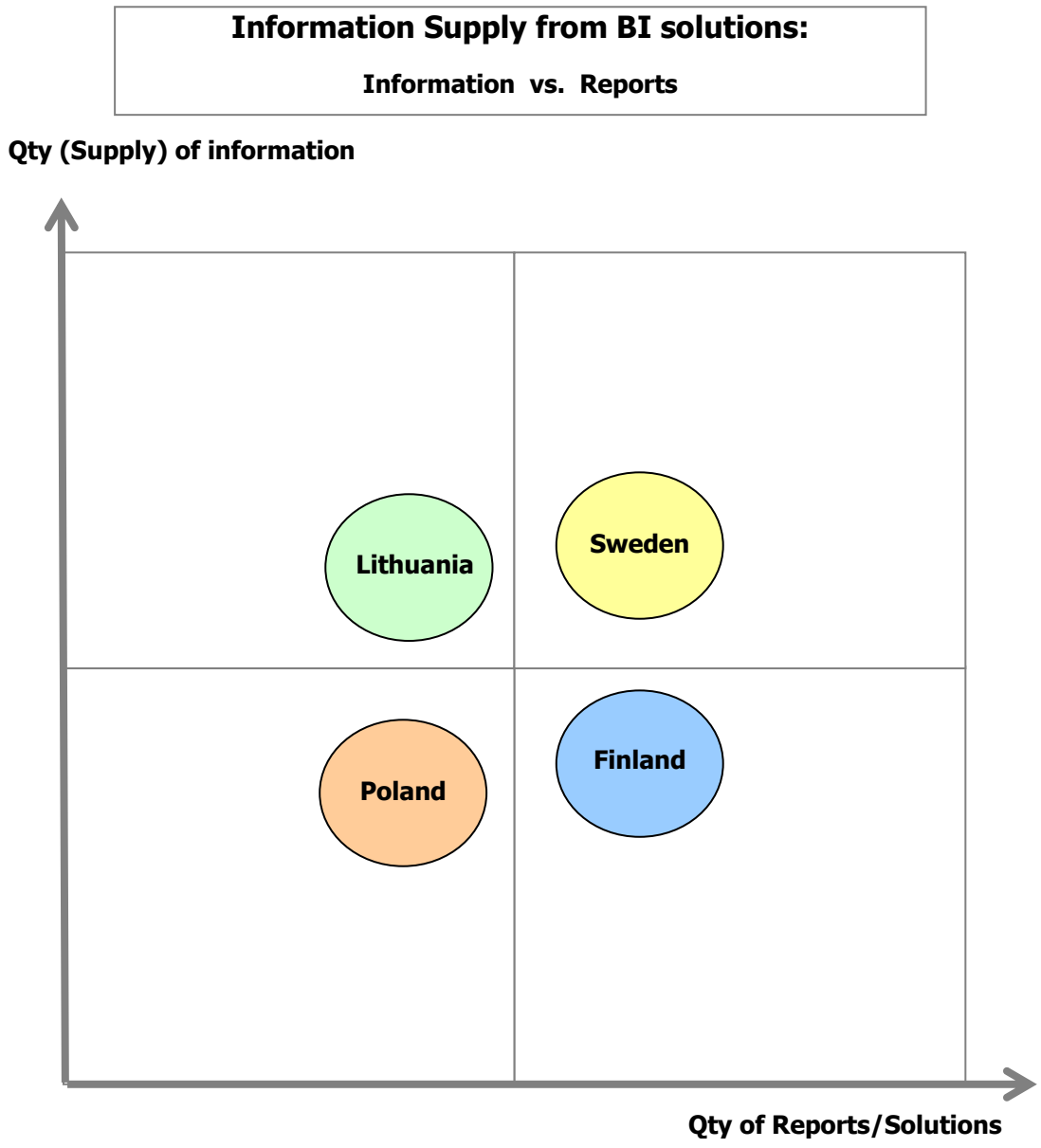
Now let's think about long term Paroc BI strategy from a bit another angle. Here is simplified picture of current Paroc BI tiers. ERP , PRIPS and Hyperion basically are the main reporting sources in near future. Data warehouse is emerging tier between data source and reporting:





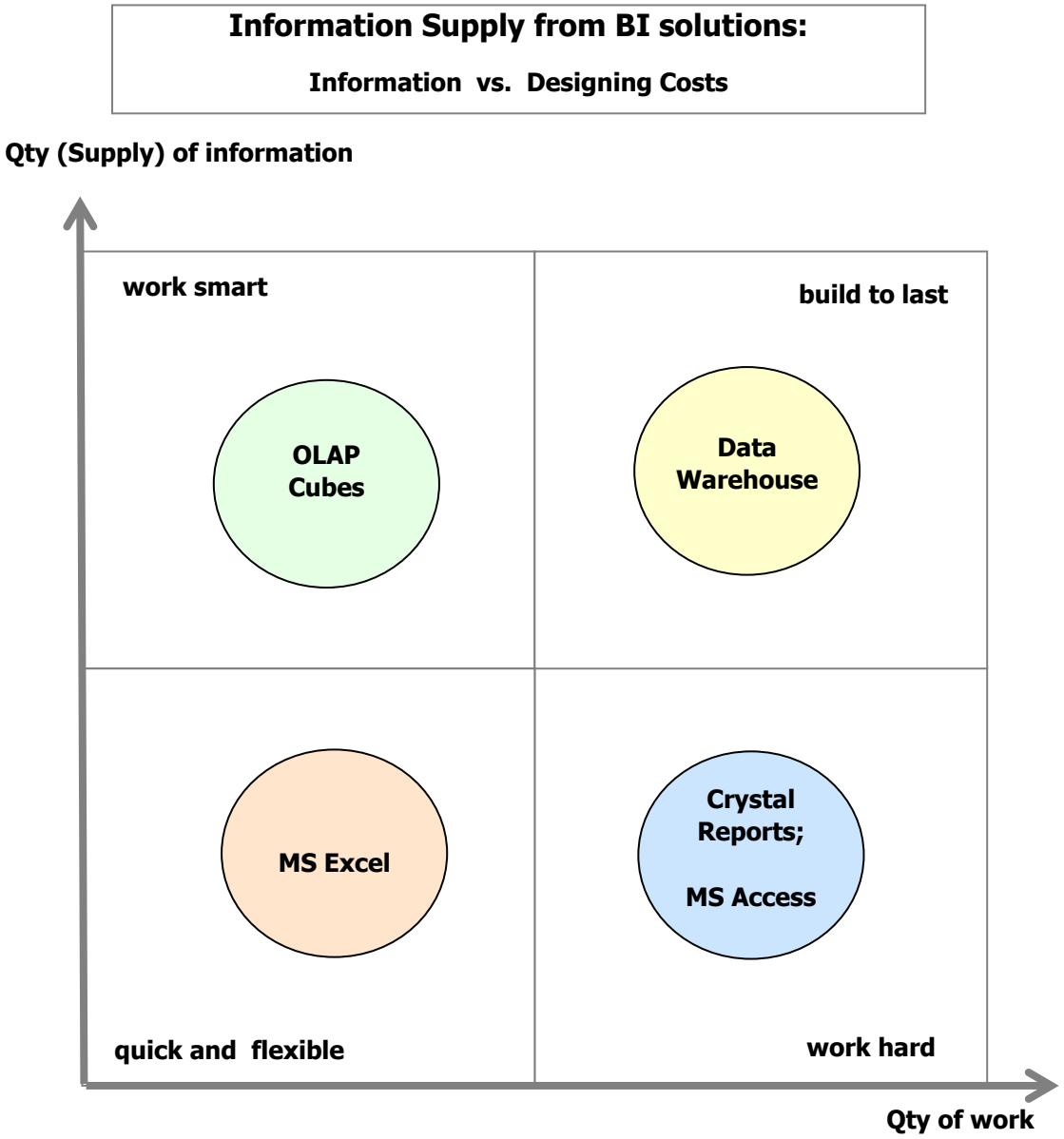
In a long term perspective data amount in IFS, PRIPS and perhaps other data sources will grow. Data Warehouse will grow too. OLAP solutions should reduce amount of static reports and work needed to produce and circulate them among report makers and receivers. Hopefully Hyperion and a lot of manual work related with feeding data and generating report will disappear from Paroc BI map. Idea of global ERP system is to have all Paroc Group data in one place in order to reduce manual work and shorten time of information gathering from different sources.

As discussed before, for good BI solution efficiency is very important to have not too much different tools and fragmented solutions. Key denominator of company BI efficiency is ratio between amount of information and solutions. Ideally one solution, platform or reporting environment should provide all information satisfying all reporting needs. Here is my "Magic Quadrant":



It is rather symbolic location of Paroc producing countries – I had to put it simply. Picture has no measured fact data behind.

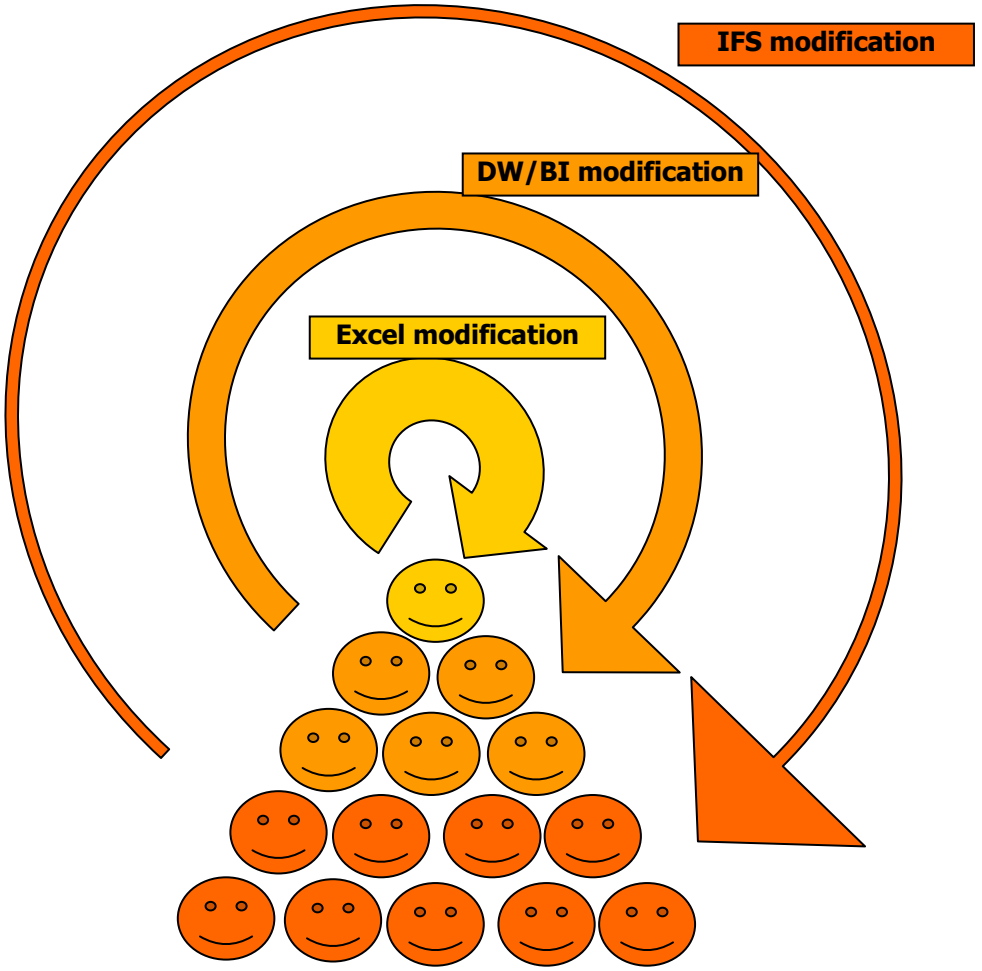
And here is similar "Magic Quadrant" only in X axis Qty of Work is put instead of Qty of Solutions:



MS Excel is in opposite corner of Data Warehouse. With little work, little information is produced in Excel, but quite often is not worth put all marginal reporting needs in data warehouse, because it is very time consuming activity. Designing of nice looking static reports with MS Access or Crystal Reports is also very time consuming activity, but one report usually satisfies only one small need.

While one OLAP cube may provide large volumes of information. Common, typical layouts can be presented by OLAP designer while various ad-hoc layouts can be quickly configured-out by front-end–user or with a help of OLAP designer.

BI development is a constant need. New and new reporting needs arise every year. To decide how to meet it, here is a schema of 3 types/ranges of modification loop:



A lot of various individual reporting needs can be quickly satisfied in Excel by individual who needs it or his/her assistant. It is a very short range but often/wide loop.

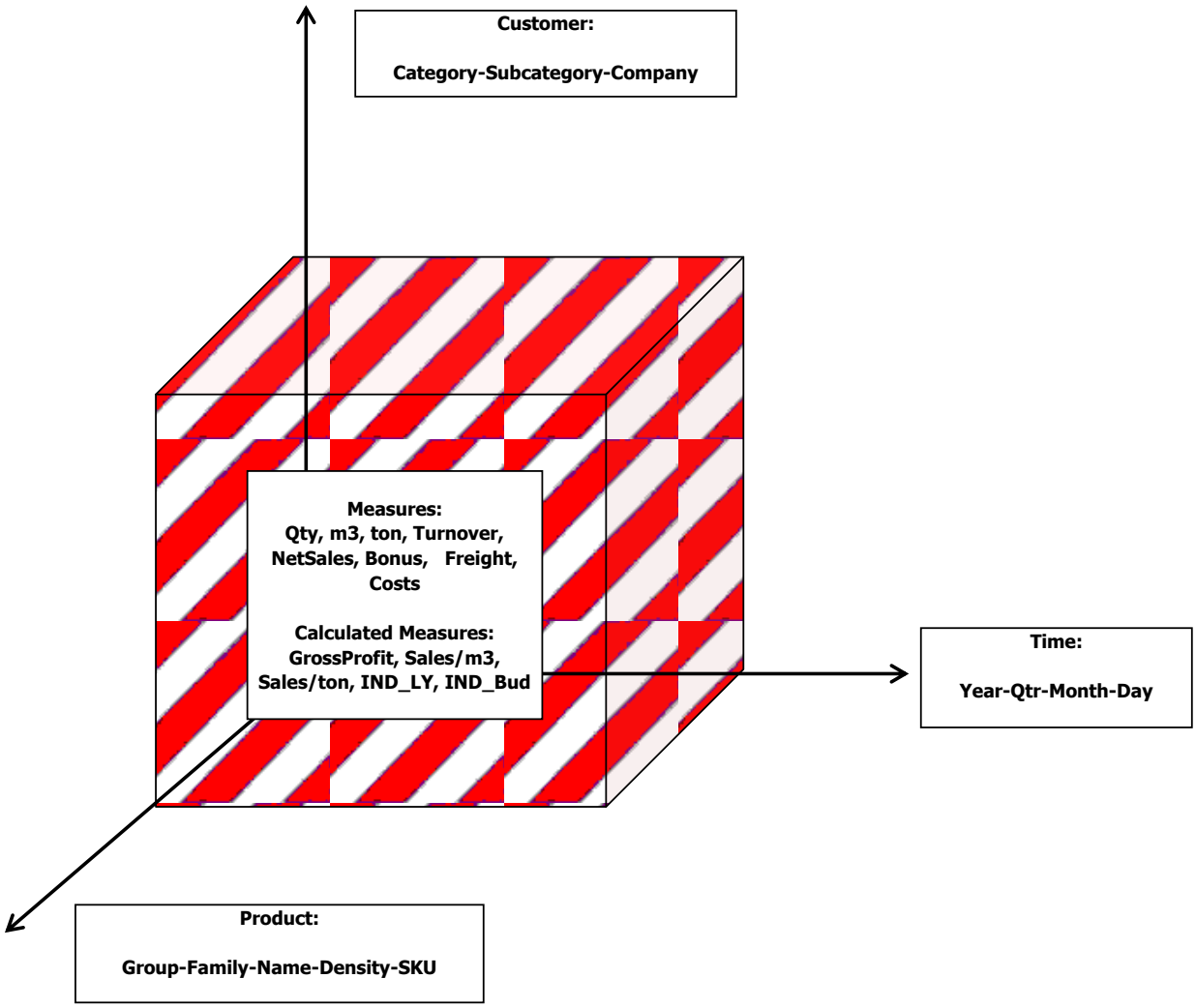
If a need is common for many people, and there is significant time costs caused by multiply manual work, IT should consider creating of automated solution. If all needed data is available and usable, some DW/BI modification could be quite quick and effective solution. It is a medium loop inside Paroc company resources.

But it can be so, that problem lies in the ERP data source. If reporting need is really global, ERP system should be altered. This could lead to inevitable need to change some ERP setup parameters or even code modification. It is a long and slow loop, kind of "thin-red" line which has to be considered carefully.

And finally I'd like to discuss problem of building PG wide analytical workspace. It is very important that all countries would have identical data structures and business logics. Hopefully common ERP will force to that. But could happen so that some countries will customize IFS according their own needs, mentality and convenience.

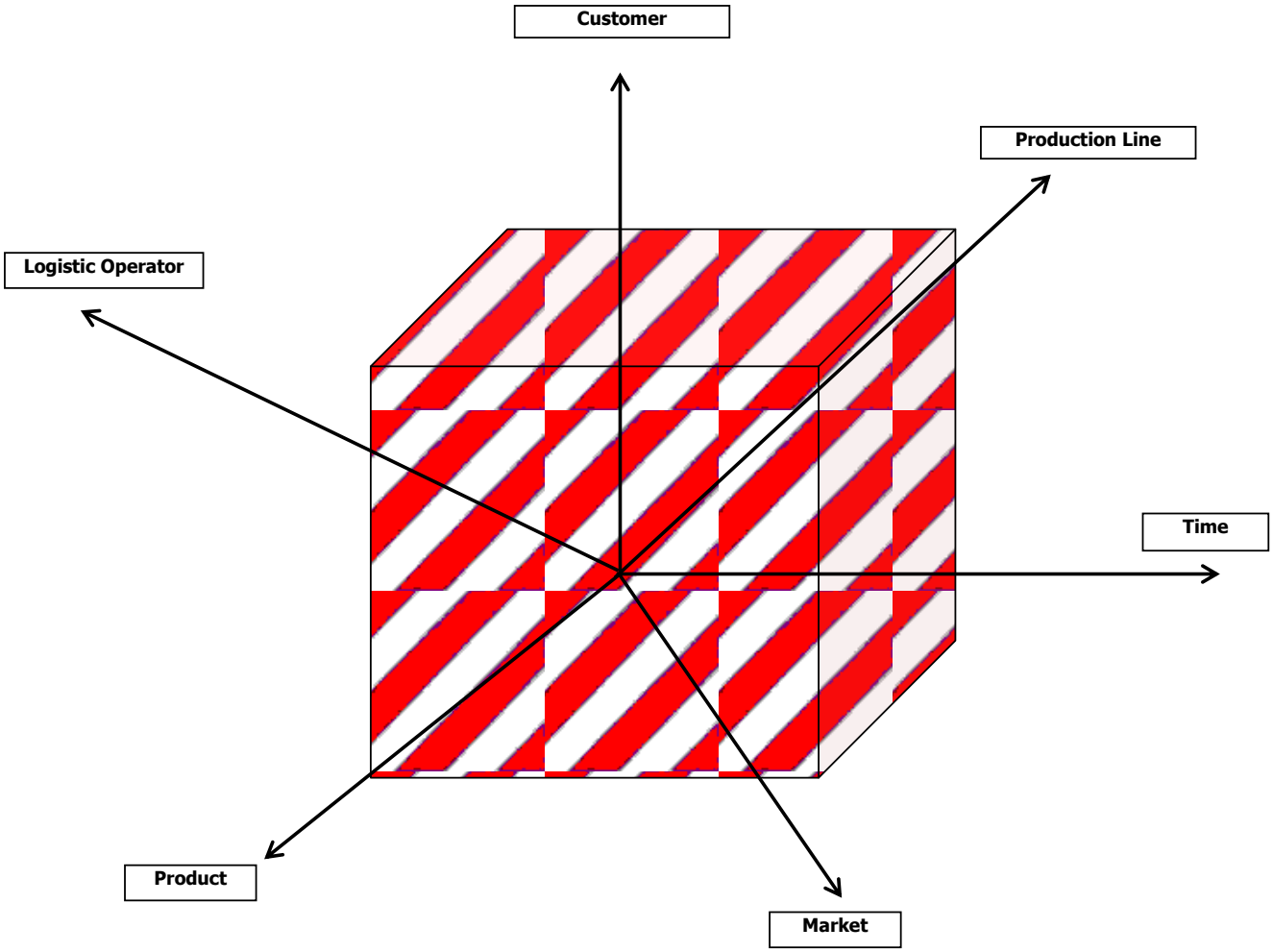
It happened so with Scala in Paroc sales countries. In the beginning systems were implemented in the same way, but in a long run data shape, standards and logic have evolved to unique applications.

Here is an example of classic Sales cube. It consists of 3 dimensions and 14 measures:



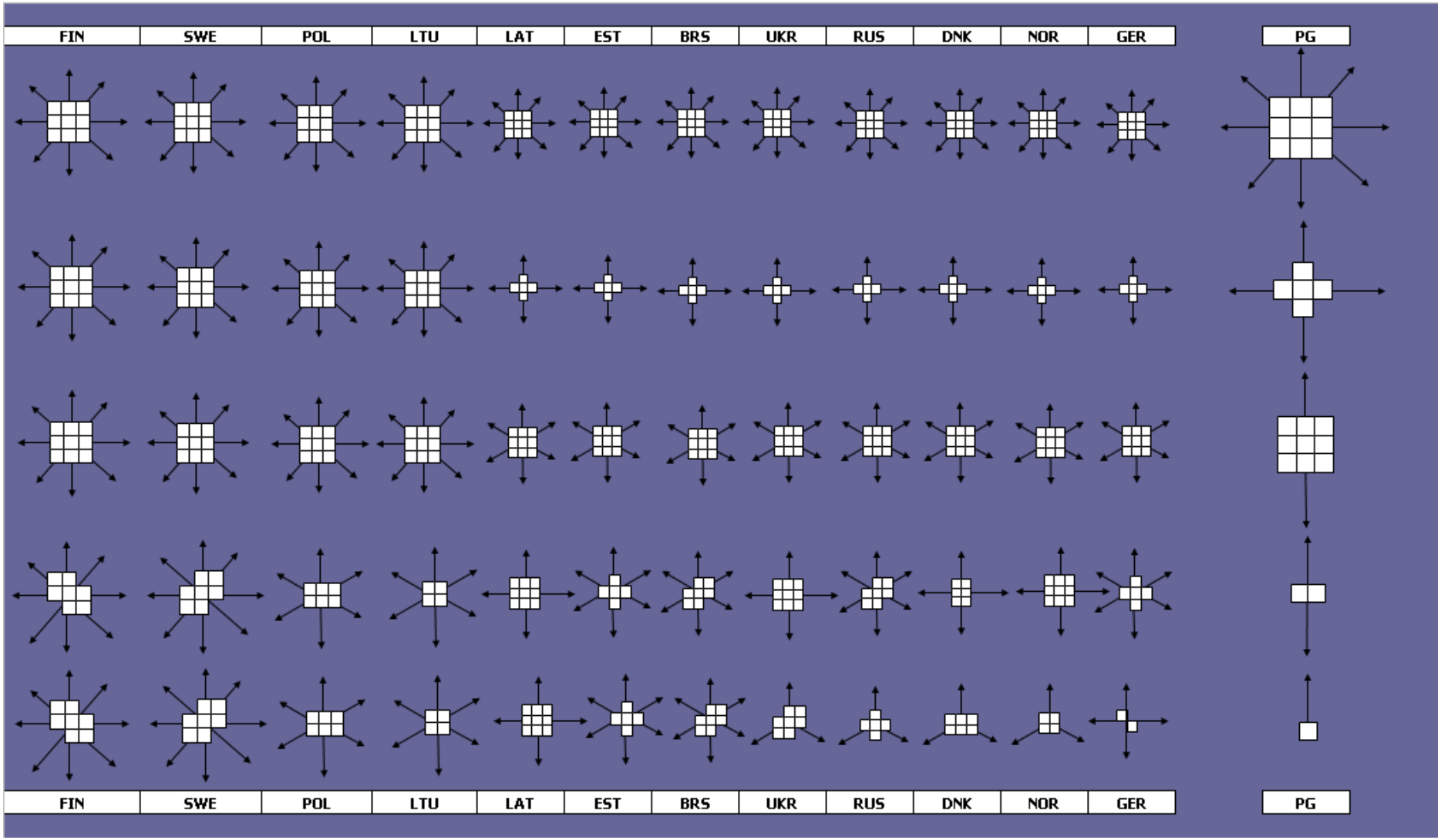
And here is more developed cube with 6 dimensions. It is difficult graphically represent 6 dimension "cube" on 2D paper. Anyway try to imagine that there are 6 dimensions. Is it too hard ? Well, I can imagine that 3D cube is kind atom. Then 6D cube is made of those 3D atoms which are lined-up along 3 dimensions of space to shape another 3D cube.

But for further needs let's picture it in simple 2D form.



Now try to configure-out what will be result if we try to consolidate those 2 different cubes to one hyper-cube? Right, result would be summed data from only those dimensions and measures which exist on both cubes. That's why it is so important to have identical dimensions, hierarchies and measures in all PG country data sets. If one dimension is missing in one country, it makes that dimension logically unavailable in PG analytical workspace.

And here is an illustration of consolidation countries cubes to PG hyper cube (doesn't it looks like IQ test ?)



Perhaps it would be not enough to get PG analytical workspace with only one dimension and one measure, e.g. total PG sold tons by time.

And here comes another challenge. It is PG hyper-cube information accuracy and reliability. Final accuracy would be something similar to weighted average of countries information accuracy. Not bad if largest sets of producing countries information are highly accurate. Perhaps particular sales country's information rounding factor would have not so big affect on total PG result.

But here comes more crucial factor of information reliability and availability. DW is quite complicated system. There is no 100% reliability that all ETL routines complete successfully. There may by that some logical condition changes and predefined procedures fail to process data according supposed logic.

The more complicated data sources - the more sophisticated DW logics - the more "IF" conditions and finally - the lower reliability. 95% is excellent result, meaning that only 3 times per year certain information is not available, incorrect or outdated. If every cube of 12 countries are 95% reliable, what would possibility that PG hyper cube shows correct information ? According theory of probability – only 54% !

Unfortunately, those are brutal realities which explain why BI project are prone to fail. Sometimes desired result is not possible, if data sources can't assure certain level of data quality and integrity. Even though data warehousing is very time consuming and often unrewarding activity, I'd like to end with more optimistic tune. With implementation of common Paroc Group ERP system, wide horizon opens for interesting and long lasting BI developing activities.