ORTEC Predicts the Payback Period for its Workforce Scheduling Software

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Abstract

ORTEC is a Netherlands-based software company selling decision support systems based on operations research models. One of her products is HARMONY, a workforce scheduling package. We developed a model to predict its return on investment for a specific customer. The model uses a database of reference implementations to find organizations that are similar to the prospective customer's organization. The costs and benefits have been broken down into several factors and we use this detailed information from the reference implementations to create a prediction of the return on investment for the workforce scheduling package. Using the information from the reference set allows us to move from industry-averages for potential savings to a prediction of potential savings based on the actual experiences from similar organizations. This also makes the model transparent: the outcomes can be traced to the elements that were selected from the reference set and a detailed description of the model is available. The model has been implemented successfully at ORTEC and has been of decisive value for several prospective customers. From the data analysis it appears that organizations can save a lot both on the time needed for planning and on the amount of personnel needed. In most cases, the payback time of the OR software was less than one year.

Keywords: Workforce scheduling; Rostering; ROI; Cost-Benefit analysis; Decision support systems; Manpower planning

Introduction

Workforce scheduling is a complex problem in which many constraints such as flexible workplace agreements, shift equity, staff preferences, and part-time work have to be met (Ernst et al. 2004). It involves the creation of work timetables for the staff of an organization in such a way that the organization is able to meet the demand for the goods or services it offers in a cost-effective manner. Many health institutions face such problems. The limited availability of staff, in terms of the number available, the times at which they are available, and the costs associated make this a difficult problem.

As the number of staff to be scheduled increases, it becomes difficult to create schedules using a plan board or generic software such as a spreadsheet package. Workforce scheduling software provides organizations with advanced planning tools that can reduce the effort required to create the schedules, increase the quality of the schedules generated, and increase the transparency of the planning process. The cost for this type of software, both in terms of direct costs (license and support costs) and in indirect costs (changes to current processes, training of staff, potential negative impact on the schedules) is high but this is offset by the potential for savings, both in the scheduling process itself and in the quality of the schedules and rosters generated. Yet organizations may hesitate to buy such a package because they are uncertain whether the claimed benefits will materialize in their specific case. As with most software, the direct costs can be clearly identified but the indirect (or hidden) costs and the benefits are less certain.

In short, management wants to know whether the implementation of such a package will pay off, or in other words, what the return-on-investment (ROI) will be. The challenge we face then is to find a way to predict this return-on-investment in a manner that can be easily integrated into the package selection/evaluation process and that will convince management.

The first requirement means that the information needed for the assessment should be available during this process. To meet the second requirement, we need an approach that is transparent and that relates the assessment to proven benefits that have been achieved in prior implementations of the package.

ORTEC HARMONY

The HARMONY workforce scheduling package has been deployed in a range of organizations such as ambulance services, refineries, security firms, and hospitals, typically with round-the-clock operations. The majority of the customers are located in the Netherlands, but the package has also been deployed in countries like Germany, Israel and the U.S.. A key benefit of the design of HARMONY is that it does not require customization for a specific customer.

The typical planning period considered is a month and the number of employees per scheduling group ranges from 20 to 40: thus, in most cases some 500 shifts need to be planned. The package supports a variety of constraints that are used as input for the scheduling algorithm. HARMONY solves the “shift assignment” problem: assign as many shifts as possible to employees, given the shifts for a period, the employees that are available for (a part of) this period, the qualifications of employees for shifts, employee preferences, (legal) requirements, and ergonomic criteria. Below we briefly summarize a description of the methods used in HARMONY which has been taken over from (Fijn van Draat et al. 2006).

Dealing with Constraints

HARMONY features two classes of constraints: hard constraints (or requirements) and soft constraints (a.k.a. criteria). The requirements have their origins in legislation, industry agreements such as collective labor agreements, organizational guidelines, and individual labor contracts. The origins of the criteria are in ergonomic considerations and staff preferences. There are approximately 60 requirements and 20 criteria in HARMONY. Among these are constraints on single shifts (required skills and the location), on the eligibility of shifts (limits on work-time in a period, the number of night shifts, and shifts per week), on series of shifts, on rest time (per day and week, after night shifts), on weekends, and for on-call duties. For each criterion, the planner can indicate the relative importance.

The planner can provide criteria for the preferred situation per individual employee or per group of employees. These criteria can be based on contracts and on personal preferences with regards to shifts and series of shifts. The number of constraints in use can thus be quite high: a hundred constraints is typical.

Generating Workforce Schedules

The size of the problems to be solved and the type of constraints involved make it a difficult problem to solve. ORTEC has therefore implemented a scheduling algorithm in HARMONY that randomly generates initial schedules which are then refined in three phases. The first phase uses a genetic algorithm to generate permutations of the initial schedules and find the best permutation. This is followed by a local improvement phase in which we attempt to improve upon the best permutation found in the first phase. In the third and final phase, other parts of the search space are searched to avoid getting trapped in a local optimum.

In the Genetic Algorithm phase, the population consists of a (user controlled) number of individuals. Each individual corresponds to a schedule. The individuals in the initial population are constructed by dividing the employees at random in two groups, which are scheduled consecutively. By using cross-over and mutation operators, new individuals are constructed, as many as the size of the population. The next generation consists of the best individuals among the new individuals and members of the previous generation. Due to this greedy selection, the genetic algorithm phase converges (does not improve) after no more than 100 generations.

In the Local Improvement phase, we take the best schedule found in the genetic algorithm phase and apply a local optimization with two operators: exchange of two shifts and reassignment of a shift. If the result of such an operation satisfies the requirements and yields an improvement (according to the criteria), we keep the modified schedule. Depending on the size of the instance and the size of the population, this phase can take a few minutes to several hours. This local improvement phase stops when no more improvement is achieved or a user-defined time-limit has been reached.

The Variable Neighborhood Search phase (see e.g. Hansen and Mladenovic 2001) tries to improve the best solution so far by branching out of the local optimum found by the previous phases. The algorithm either clears the assignment of all shifts for a small number of employees or by clearing a random range of 25 or 50 shifts. The second phase is then repeated for the new neighborhood. The third phase runs until either a global optimum is found (i.e., all shifts are assigned and no criteria are violated) or a planner-specified time limit is exceeded.

This three-phase approach has been tested extensively and appeared to be robust.

ROI model literature

The Return on Investment or ROI criterion is a widely used concept from business economics. An ROI model provides a structured approach to compare predicted expenses or costs with expected benefits in order to forecast the returns that will be generated from the investment. ROI research in the area of scheduling software is lacking: our literature review did not turn up any relevant publications in the academic literature. Even if we widen our search to software products in general, the number of well-documented ROI studies is still quite limited.

Several software providers offer ROI models to promote the sale of their software. These may be offered as spreadsheets that can be downloaded or as online interactive web applications. A review of the use and quality of ROI models (Silvers, Kotler, and Hoch 2004) has shown that, while interest in ROI studies and business cases has increased a great deal within the information technology industry, the quality of the ROI models created by the vendors is at issue. Many ROI models are poorly substantiated and are based on assumptions and estimates. The assumptions are rarely stated, which makes it hard to verify if these assumptions are met in a practical case. The results of these models have been found to be overly optimistic. If a potential customer can not verify the results of the ROI model because the model itself or the underlying assumptions are not clear, then the results of this model will surely be met with significant skepticism. Thus, transparency of an ROI model is key to its effective use.

We have found some models that are described in more detail. These however tend to use fixed industry-averages for the expected benefits. However, as we have seen in practice, the benefits can vary substantially between organizations. A method to predict the ROI should incorporate these variations.

Our approach

The ROI prediction method described in this paper will therefore match the prospect against a set of reference implementations. The basic idea is to select the best matches as basis for the prediction. Hereafter we will first identify the cost and benefit factors as well as the factors characterizing the organizations. Next we indicate how we relate a new prospect to past cases. Thereafter we provide an example of the ROI prediction.

Costs and benefits of automated workforce scheduling

In order to set-up a ROI model, we first need to identify the costs and benefits of an advanced workforce scheduling package such as ORTEC HARMONY. From experience it appears they can be found in three major areas: the total number of hours to be scheduled (i.e., a reduction in the number of hours paid due to an improved planning with less slack), increased productivity of the planners, and a reduction in fines for violations of regulations. The benefits also depend on the planning situation before the introduction. For organizations without an existing workforce scheduling package or with a package that has poor integration with the payroll software, significant savings can also be achieved in administration. To assess these areas, we break them down into individual factors which can then be measured by ORTEC staff: the resulting benefit factors are listed in the first section of Table 1 ("Benefits"). The reduction in fines for violations has been translated into a company characteristic because it is hard to quantify: we have modeled it as an input "schedule quality" that is used to select the most similar entries from the database. To convert the benefit factors into monetary terms, we need information of the wages (for the staff to be scheduled, the planners, the administrative staff, staff overtime, and for temporary labor). We can create a prospect-specific ROI prediction on the basis of proven prior savings by combining the information on the savings from the datasets and the data such as the number of scheduling groups and the wages from the prospect.

The ROI model is designed to be used as part of the sales process. We thus have access to cost data that has been established by the ORTEC sales staff during this process (see Table 1 ("Costs")). The initial cost typically consists of a license fee, an implementation fee (a number of days by a consultant to implement the package on-site), and a training fee (the planners will be trained by the vendor). The cost of hardware is not included in the ROI model as this cost is highly dependent on the infrastructure of the individual customer and is relatively small in comparison to other costs.

Table 1: The benefits and costs of workforce software broken down into individual factors

Category	Factor	Unit/Values
Benefits	Hours to be scheduled	Percentage of Hours per month
	Scheduling time	Percentage of Hours per scheduling group per month
	Administrative work	Percentage of Hours per scheduling group per month
	Overtime	Percentage of Hours per month
	Amount of temp labor	Percentage of Hours per month
Costs	Initial cost (license, implementation, training)	Euro
	Maintenance costs	Euro per year

ROI Measures

We implemented three commonly used measures for Return-on-Investment (Bocij and Chaffey 2003): the Net Present value (NPV), the Internal Rate of Return (IRR), and the Payback Period (PP). The Net Present Value measure is a simple calculation to convert the difference between costs and benefits in future period to the current (present) value by taking the discount rate into account (the discount rate is usually assumed to be fixed for the entire lifespan: here we use a rate of 4% per month by default). The Internal Rate of Return on the other hand determines the discount rate for which the present value of the difference between benefits and costs over the lifespan is equal to zero. The Payback Period calculates the first point in time at which the difference between benefits and costs is non-negative.

For the first two measures, we need to determine the lifespan of the scheduling package. While software per se does not suffer from degradation during its lifespan, the technological and organizational setting may change over time and degrade the package's suitability. Regular updates are designed to address these issues: they are covered by the maintenance agreement. ORTEC uses a six year lifespan for this software so we will use this period.

Finding similar datasets

When the sales staff wants to use the tool for a new prospect, we have to make a selection from the set of reference implementations that best matches the new prospect. A manual selection would be inappropriate, as it may take some effort and would introduce a subjective element: this would jeopardize the desired transparency of the model. We therefore implemented a nearest-neighbor algorithm (Witten and Eibe 2005) to select the best matches from the set (an additional threshold-type algorithm was also evaluated but this did not yield an improvement over the nearest-neighbor algorithm.) The match of the datasets to the prospect is calculated using a similarity percentage. For this purpose we use a distance-weighted variant of the Nearest Neighbor algorithm (Mitchell 1997): The similarity percentage of the match between the dataset and the prospect is used as a weight (or distance) in the computation of the ROI prediction.

ROI Model Implementation

The ROI tool consists of an Excel™ software application and a database. The database stores the datasets, i.e., reference cases (customers) for which the ROI has been determined. The application matches the characteristics of the prospect to the entries in the database and selects a number of cases that match best. The data that is stored in the database is structured into two categories: the data elements, or *factors*, that are used to select the datasets that best match the prospect and the factors that are used to predict the potential benefits for the prospect. As different benefit factors may have a different impact (larger or smaller), we attach a weight to each factor.

ROI findings

A significant effort has gone into the measurements that are required to fill the database. Each case in the database consists of a baseline measurement (before the introduction of the package), a post-introduction measurement, the level of investment that was required, and the ROI that was actually achieved. To allow sufficient time for the organization to use the package to its potential and to isolate the measurement from short-term disturbances caused by the adoption of a new work routine, we performed the post-introduction measurement a full year after the introduction: this should allow us to measure the real benefits, both in terms of the quality of the schedules created and in terms of the effort required to perform this task. The long period between measurements does mean that it takes a lot of time to perform such measurements and that filling the database is a slow process. We managed to perform seven complete measurements during the 18 month development period of this model.

To support the measurements, we developed a questionnaire that structures the process to identify the organizational characteristics, the factors used to calculate the benefits and costs, exogenous developments such as changes in the volume of work per month, and the ROI that was achieved. Using the response to the questionnaire, a new dataset can be defined in terms of the organizational and benefit factors. We derived the factors that characterize an organization in the database from analysis of the cost/benefit model and discussions with in-company experts. The factors that are used to determine the similarity of an organization to the datasets and their weights are listed in

Table 2.

Table 2: The factors used to characterize workforce scheduling at companies

Factor	Unit/Values	Weight
Amount of work to be scheduled	Hours per month	4
Time required to plan	Hours per scheduling group per month	2
Administration such as interface to payroll system	Hours per scheduling group per month	2
Overtime	Hours per month	1
Amount of temp labor	Hours per month	1
Scheduling Method	Centralized (Cen) or decentralized (Dec)	4
Scheduling tool	Manual (plan board), other software	4
Schedule Quality	Number of violations of regulations per month	1

Sample ROI forecast

To illustrate the ROI model, we present a simple example. This example is based on synthetic data (due to confidentiality reasons) and uses only a subset of the model in order to simplify the presentation. The characteristics used to describe the organizations in the database are the number of contract hours of the employees to be scheduled, the number of hours of scheduling work per scheduling group, and the scheduling method. For the ROI prediction we use the percentage of benefits on contract hours and the percentage of benefits on scheduling work. This sample database consists of five datasets (see Table 3). For the selection of companies we use the two most similar entries.

Table 3: The Datasets for the ROI Example

Company	Amount of work to schedule (hours per month)	Time to plan (hours per group per month)	Scheduling Method	Benefit in schedule (%)	Benefit in planning (%)
1	160,000	21	Dec → Dec	4 %	28 %
2	45,000	23	Dec → Dec	3 %	32 %
3	90,000	22	Dec → Cen	3 %	51 %
4	105,000	17	Dec → Dec	5 %	18 %
5	250,000	19	Dec → Dec	4 %	30 %

On the basis of this database, we can now calculate an ROI prediction. The prospect has to schedule 75,000 hours of work per month for 15 separate scheduling groups (the equivalent of 450 full-time employees), which currently takes the decentralized planners 18 hours each month per scheduling group. The organization of planning will not change. The average hourly wage is € 26.30: the hourly wage for the planners is € 25.80. It costs € 75,000 to purchase the software license and the annual maintenance fee is € 13,500.

Determining the most similar companies

The similarity of a reference company to the prospect is a weighted average of the similarities on individual factors listed in

Table 2. We developed several methods to determine similarity on the individual factors, including simple comparison (with value of 1 if the factors match and 0 otherwise), group comparison, and fuzzy comparison functions. The result is a value in [0,1]. For example, the "scheduling method" factor is converted into a binary (0/1) factor using simple comparison: it indicates whether the scheduling methods used before and after the introduction of the package are similar to the prospect's situation. The fuzzy comparison method is used for the amount of work to be scheduled. The results of the calculation are shown in the Table 4 (see Appendix A for details).

Table 4: The similarity factors and percentages for the example

Company	Amount of work to schedule weight 4	Time to plan weight 2	Scheduling Method weight 4	Similarity Percentage to prospect
1	0.5	0.4	1	68 %
2	0.8	0.0	1	72 %
3	0.9	0.2	0	40 %
4	0.8	0.8	1	88 %
5	0.0	0.8	1	56 %

Selection of companies

We select the two datasets that have the highest similarity percentage, i.e. datasets 2 and 4, with similarity percentages of 72% and 88% respectively. These similarity percentages are then normalized to get a relative weight of each dataset in the ROI calculation (the second column of Table 5). The overall similarity index for the ROI procedure (here, this value is 80.8%) provides the prospect with an indication of the quality of the match between his organization and the entries that were selected from the database. A higher value should generate more confidence in the quality of the ROI prediction.

Benefits

Using the data from the selected datasets and the data of the new situation, a forecast of possible benefits can be made. In this case two types of benefits are predicted, namely benefits on labor costs for contract hours and benefits on the time needed for scheduling. The weighted benefit factors from the reference datasets are 4.1% for the contract hours and 22.7% for the scheduling hours (the details of these calculations are in Appendix A and the results are in Table 5). These relative benefits are then converted into monetary terms, which yield a benefit for the contract hours of € 80,873 and € 1,581 for the number of hours required to perform the scheduling. The combined potential benefit is the sum of these two benefits: € 82,454 per month.

Table 5: The benefit split up into individual factors for the example

Dataset	Normalized Weight	Amount of work to schedule (%)	Amount of work to schedule (€)	Time to plan (%)	Time to plan (€)
2	0.45	1.35	26,629	12.8	892
4	0.55	2.75	54,244	9.9	689
Total:		4.10	80,873	22.7	1,581

ROI calculation

With this information on the potential benefits and the available data on the cost of the software package, we can now calculate the ROI measures. As an example we have calculated the payback period as this measure is used most in practice. The calculation is illustrated in Appendix A. In this case, the payback period is 0.9 month. In the ROI tool, we also implemented two alternative calculations that model a positive and a negative scenario. In this way, we can model some uncertainty regarding the input data and the assumptions in a range of potential outcomes. In this example, the scheduling package has a payback period between 0.7 and 1.2 months. This is an extremely short payback period and it illustrates the potential impact of savings on the amount of work to be scheduled. The tool generates a report that lists the input data, the organizations that were selected as the most similar to the prospect's organization, the predicted benefits (in relative and absolute terms), and the predicted ROI measures. A sample report is listed in Appendix B. A key feature of the report is the list of similar organizations: the prospective customer can contact these organizations and learn first-hand from their experiences with the workforce scheduling package.

Verification and Validation

As with any model, it is critical to verify the correct workings and to validate that the model is an accurate representation of the system being modeled. To verify the model, we first asked in-company experts to check the datasets. Using the basic data such as company characteristics, the experts were asked to determine the ROI. This outcome was then compared with the ROI in the dataset. We found that the results from the experts exhibited a small deviation (3%-8%) from the actual ROI: this difference is small enough to consider the datasets verified.

The validation of the ROI tool was performed by monitoring the introduction of HARMONY in three more organizations. A full year after the introduction of the package, we gathered the data and used the ROI tool. For two out of three cases, the results were very good. The difference between the ROI obtained in practice and as predicted by the ROI tool was less than 14%. In one case, the results were less accurate in relative terms (off by 60%) but this reflected an actual payback period of two months versus a predicted payback period of four months: the absolute error was thus quite small.

The results of the verification and validation effort gave us sufficient confidence in the tool to deploy it within ORTEC.

Observed Savings in HARMONY implementations

Advanced workforce scheduling software can yield significant savings in terms of the number of hours to be scheduled (and paid for) and in terms of the effort required to perform the scheduling itself. In practice we found that organizations typically start with a focus on the planning process. Once the package has been implemented and the new planning process is operational, they will start to focus on making the most of the available options in the scheduling software to improve the quality of the schedules. Here, consultants from ORTEC will be involved to make the most of the available options within the specific context of the organization. Both phases can take up to six months (which is also the motivation for the timing of the post-introduction measurement in this method).

From the initial data collection for this project we learned that the savings for the first factor range from 0% (for organizations that already used a different scheduling package or had excellent manual scheduling staff) to 8.8%. For example, one organization in our initial database saved 6.5% on the number of hours scheduled (a reduction in the number of hours per month by 32,500) which translated to just over € 900,000 per month. For the second factor, i.e., the number of hours that the schedulers need to create the roster, the savings range from 16.7% to 80%. Finally, for organizations that did not have an interface from the workforce scheduling software to their payroll systems, the savings range from 23% to 80% in terms of the number of hours required for this task. It is clear that the number of hours scheduled has the greatest potential for savings: even a modest one percent reduction in this number results in a significant benefit.

Conclusion

The ORTEC ROI model substantiates the financial benefits of its workforce scheduling software. The tool uses a database of existing cases with known benefits and retrieves from that database those entries that best match the prospect. It then predicts the benefits using relative weights for each benefit factor: additionally, entries that provide a better match with the prospect get a higher weight in this prediction than entries with a lower match. The tool produces a summary report in which the company characteristics, the best matches from the database (with the similarity index), the predicted benefits (in relative and absolute terms), and the predicted ROI measures are listed.

An important characteristic of this ROI model is that it does not rely on fixed, industry-wide percentages of expected benefit. The main advantages of this approach are that the ROI prediction should be more accurate, that the comparison will make more sense to the prospect, and that the list of organizations selected from the database can be used as references. A critical factor in this approach is the availability of detailed data regarding prior implementations. As we have experienced during the development of the model, extracting this data is a non-trivial exercise. It requires cooperation of the customer, including a willingness to disclose financial and scheduling data. The time that is required between the pre- and post-introduction measurements complicates matters. On the one hand one would like this time to be as short as possible (to obtain the data sooner and limit the impact of external influences) but on the other hand one has to allow sufficient time for the organization to absorb the shock of changed work practices and to take full advantage of the facilities offered.

The ROI model has thus far been applied in five sales projects and in one of these projects the ROI model was critical in winning the contract. Overall, we conclude that the development of a transparent and extendable ROI model has benefitted ORTEC and its customers. The use of a reference set of similar organizations supports an ROI prediction that is more relevant to the individual organization than using generic industry-averages. A side effect of the development and usage of this model is that the vendor demonstrates a clear commitment to its (potential) customers to help them solve the difficult issue of determining the return-on-investment during the package selection process.

Appendix A: Calculations for example

The base data for the example is listed in Table 3. With the weights (w_i) and the factors (f_i) we can calculate the similarity percentages G_d (the results of these calculations are listed in the last column of Table 4). For the first row this is:

$$G_1 = \frac{\sum_{i=1}^{3} w_i f_i}{\sum_{i=1}^{3} w_i} \times 100 = \frac{2 + 0.8 + 4}{10} \times 100 = 68\,.$$

We select the two datasets that have the highest similarity percentage, i.e. datasets 2 and 4, with similarity percentages of 72% and 88% respectively. The normalized weights (W_i) are 45% for dataset 2 (72/(72+88)=0.45) and 55% for dataset 4.

With these normalized weights we next determine the similarity index of the ROI forecast:

$$P = \sum_i G_i W_i = (45 \times 0.72) + (55 \times 0.88) = 32.4 + 48.4 = 80.8.$$

Using the data from the selected datasets and the data of the new situation, a forecast of possible benefits can be made. In this sample case two types of benefits are realized, namely benefits on labor costs for contract hours and benefits on the scheduling work. The weighted benefit factors from the reference datasets are 4.1% for the contract hours (0.45 × 3 + 0.55 × 5=1.35+2.75=4.1) and 22.7% (0.45 × 32 + 0.55 × 18 = 12.8 + 9.9) for the scheduling hours. The benefit for the contract hours is now 75,000 × 0.041 × 26.30 (the number of hours times the potential savings times the cost per hour), or € 80,873. Similarly, for the number of hours required to perform the scheduling, the benefit is 18 × 0.227 × 25.80 × 15 = € 1,581.

We can now determine the payback period (*PP*) using the calculated benefits (B = 80,873+1,581 = 82,454) and the total costs for the acquisition of the package. Recall that the license cost A_0 is 75,000 and the annual maintenance cost A_m is 13,500.

$$PP = \frac{A_0}{B - \left(A_m/12\right)} = \frac{75{,}000}{82{,}454 - \left(13{,}500/12\right)} = \frac{75{,}000}{81{,}329} \approx 0.9 \text{ month.}$$

Appendix B: Sample ROI Report

Customer Characteristics for intercompany comparison

Contract hours:	54,000	hours/month	*Schedule groups:*	50
Overtime:	870	hours/month	*Scheduling method:*	Decentral → decentral
Temporaries:	924	hours/month	*Current scheduling system:*	Manual
Scheduling work:	1,000	hours/month	*Schedule quality:*	Moderate
Administration:	400	hours/month		

Selected companies (k-nearest neighbor with k=3)

Org1	71%	*(actual name withheld)*
Org2	53%	*(actual name withheld)*
Org3	50%	*(actual name withheld)*

Benefits

Contract hours:	0.0%	€ 0
Overtime:	0.0%	€ 0
Temporaries:	5.08%	€ 1,320
Scheduling work:	27.76%	€ 7.811
Administration:	23.09%	€ 1,805
Total saving per month:		€ 10,936

ROI

Payback period:	12	months	*Similarity index:*	60%
NPV:	€ 557,925			

IRR:	99.34%

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Verification Letter

Ron Hendricks, Capacity manager Orbis Medical Care Group (Sittard, The Netherlands) stated:

During early 2007 we started a selection for a workforce scheduling solution. Based on the results of a Return On Investment study, we decided in September 2007 to choose for ORTEC Harmony. The ROI study showed substantial savings, resulting in a payback period of 24 months. Up to now we have realized a reduction of overall personnel costs of at least 3 percent, based on a total budget of 120 million euro.