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The impact of data accuracy for efficient and feasible routing plans

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Abstract The main basis of long co-operation between logistic service suppliers and their clients is the satisfaction of these latter. Commissioners are satisfied if the service provider delivers the products in expected condition and time while asking acceptable price for this. Logistic companies can meet these expectations in case they are able to plan, to simulate their tasks in advance and to realize this with the utilisation of resources according to the plan. Exact planning is essential for the effective execution. The goal of this analysis is to show how the accuracy of input data will influence the punctuality of the routing plans.

1 Defining the data required to execute the simulation

In order that the exploration of connections between the simulation and execution of delivery tasks to be founded, processions have to be presented through a worked-out example based on real data. With the biggest Hungarian 3PL provider data have been analysed from both the order side both the planning and execution side. The goal is to find out what is the connection between the sequence and punctuality of the available and usable data and the results and their goodness.

Data connected with resources are given so they will have constant values in course of the simulation process. Four types of data have been featured which are not constant or not available all the time but their quality can influence the result of simulation. After that 4 punctuality rate were set up and then with the combination of these we examined the simulation results plus a comparison were created with the real index numbers [1].

After having determined the data types and punctuality categories we choosed an accomplished route where data was known and enough information was available about the parameters of delivery tasks. These addresses were situated in Budapest what is important for the map details.

The received results were compared with the data of the delivery accomplished in reality on the basis of four parameters. The explanation for the choice of 4 parameters is that the effectiveness and efficiency of the job done in the distribution systems are monitored and measured by the service providers. These are:

- run (km's),
- working time (minutes),
- driving time (minutes),
- vehicle number (piece).

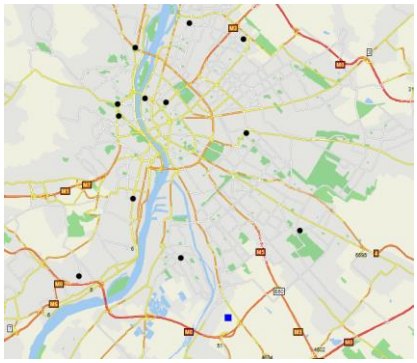

Figure 1. Location of the depot and the points to be visited

The four parameters were allocated into groups on the basis of the accuracy of the prime data, categorized, and compared with the numbers of the actual performance. On the strength of these the prime data and the executability of the simulation carried out were defined that means the correlation between goodness stated earlier.

Based on features of the data simulations have been placed into four main groups. The maps available from A (sketchy) to D (punctual street level, restrictions).

Table 1 Ordered quantities (kg)

identity	avg quantity	rough	approximate	punctual
A001	78	100	175	192
A002	78	100	125	144
A003	78	85	90	106
A004	78	60	55	47
A005	78	80	90	92
A006	78	60	55	34
A007	78	60	40	15
A008	78	70	60	55
A009	78	70	60	59
A010	78	100	110	120
A011	78	60	40	35
A012	78	60	50	40

Table 2. Loading times (mins)

identity	avg. loading	rough	approximate	punctual
A001	18	20	22	25
A002	18	25	30	35
A003	18	19	19	20
A004	18	17	16	15
A005	18	19	20	21
A006	18	15	13	12
A007	18	15	12	10
A008	18	17	16	15
A009	18	17	16	15
A010	18	20	25	28
A011	18	15	13	11
A012	18	16	14	12

Table 3. Opening times

identity	avg opening	rough	approximate	punctual
A001	7-15	8-12	8-9	8-8:15
A002	7-15	7-12	7-10	7-9
A003	7-15	8-12	9-10	9-9:30
A004	7-15	7-13	8-13	8-12
A005	7-15	8-12	9-11	9-10
A006	7-15	7-12	7-10	7-8:30
A007	7-15	7-13	8-13	8-12
A008	7-15	8-14	8-13	9-13
A009	7-15	8-14	9-14	9:30-13:30
A010	7-15	7-12	7-10	7-8
A011	7-15	8-13	9-12	10-12
A012	7-15	8-13	9-12	9:30-11:30

With the mixing of the groups 88 different simulation results have been compared to the data of actually performed execution. The comparison has been made with cross-checking the km run, the working time, the driving time and the number of vehicles.

2 The software

For creating the simulations the Paragon vehicle routing and scheduling system has been used which is the product of Paragon Software System Plc. based in UK. The software is used in more than 50 countries around the world. Paragon works with a similar algorithm like another routing software.

3 Results of the simulation

The results of simulations and the data of actual executions were summarized in Table 4. I determined how big is the derogation between the values calculated by simulation and the actual data as a percentage and from these we calculated the average punctuality. This was done in two steps as drops could be carried out only with two vehicles in the course of the real execution because of the tightness and overlap of opening hours. For this end those versions where the system was able to solve the task with a single vehicle through the simulation haven't been taken into account. In the other cases one average value has been calculated from the deviation of distance and time data in percentage where all three parameters were equally taken in to account.

Table 4 shows the four most punctual variations. I examined the quantity, the quality and the accuracy of data, the index values of the created plans and contrasted them with the data of the routes actually carried out [3, 4].

Table 4. Comparing the data of simulations and actual delivery

	km	working time	driving time	vehicles
Realised	143	612	275	2
A8	168	472	256	2
B4	119	461	240	2
C5	132	481	262	2
D4	135	585	258	2
	punctuality			
Realised	100%	100%	100%	100%
A8	117%	77%	93%	96%
B4	83%	75%	87%	82%
C5	92%	79%	95%	89%
D4	94%	96%	94%	95%

4 Conclusions

On the basis of the executed simulations and the examination of the company data the following conclusions can be drawn:

- the goodness of data is principally affected by the punctuality of opening hours. The more punctual these data are, the more it can be stated that, because of the contingent tight opening hours, the quickest route has to be turned over and that on the ground of the working time or the territorial distributions how much lack of resource this would create.
- accuracy of the maps in itself is an important factor than of the opening hours but handling them together such factors appear which will increase the affection of map's quality caused on the goodness of simulation.
- the rightly defined average order quantities do not necessarily influence the goodness of simulation in a negative way, real quantities' variance from the average value in positive and negative directions extinguish each other quite well.
- in connection with loading rates I concluded to the same as in case of punctuality of the order quantities.

Beyond that it seemed to examine what rate the distance and time data derived from the simulation vary depending the change in the input data [2, 5]. Here beyond this simulation those company data were also analysed which had been given as confidential. Relationship readable from the tables below could be set out also through making of the analysis done with company data.

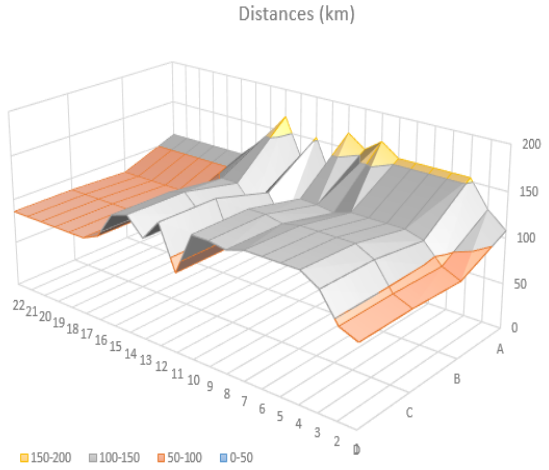

Figure 2. Distance data in relation to the feautures of input data

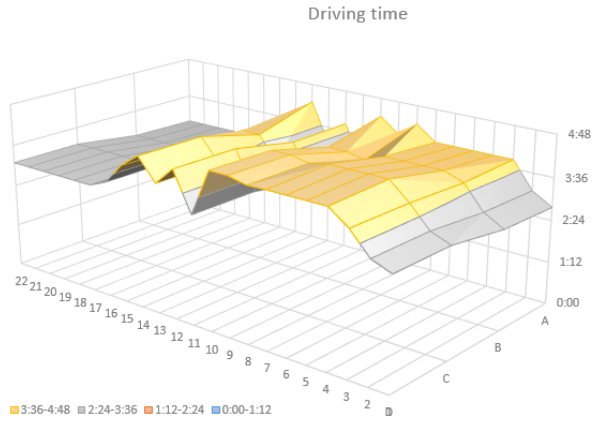

Figure 3. Driving time data in relation to the features of input data

It can be drawn on the basis of comparisons of the analysis that if the changing in the input data cause higher run performance in the simulation then together with this but in diverse extent the working and the driving time would grow, too.

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