Summary Report – 1st Project Workshop

Improving Demand Forecasting Education in Turbulent Times and Beyond at Industrial Environment

Visegrad Fund, Grant No. 22520049 · Project period: 1 October 2025 – 30 November 2026
Date and venue: 14 September 2026, GTE headquarters, Czobor u. 68, 1147 Budapest (hybrid event)
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1. Purpose and programme of the workshop

The first public workshop of the project presented the demand-forecasting curriculum developed jointly by the three partner countries (Hungary, Poland, Slovakia) and opened it to professional debate. The event was free of charge, registration-based and hybrid; the presentations were followed by a moderated discussion. The workshop was built around three questions: how artificial intelligence is rewriting the forecasting process, which competencies the demand planner will need by 2030, and what turns demand planning into a strategic role.

Programme item	Speaker / organisation	Language
Project presentation: background, survey, curriculum map	János Mondovics – GTE	Hungarian
From Forecasting Challenges to Forecasting Maturity – The Polish Perspective	Robert Ulewicz, Manuela Ingaldi – Częstochowa University of Technology	English
Demand forecasting in intelligent manufacturing – educational materials and two worked problems	Peter Košťál, Vanessa Prajová – Slovak University of Technology, Trnava	English
Outlook: visions of the future and the demand planner in the age of AI	János Mondovics – GTE	Hungarian
Moderated discussion, closing questionnaire	participants	Hungarian

2. Project presentation – GTE (János Mondovics)

Background

The speaker traced the professional roots of the project to logistics planning at Dreher (1995–2008), the EU projects of IFKA's Logistics Development Centre (2008–2012) and the forecasting-culture surveys run by the Forecasting Section of the Hungarian Association of Logistics, Purchasing and Inventory Management (MLBKT) since 2017 (2017, 2019, 2022–23). He has taught the Forecasting course at the MLE Advanced Logistics Management Programme since 2020 and wrote the chapter "Forecasting methods tailored to the simulation process" for the University of Miskolc's V4 project. GTE's Visegrad project, launched in 2025, builds on this line of work.

Flash survey on forecasting quality (2025)

Work package 1 of the project ran a small-sample survey of forecasting culture in the three countries. Average forecast accuracy in 2024 was almost identical across them: Hungary 74.7% (±18.6), Poland 74.1% (±12.3), Slovakia 72.9% (±9.4). The Hungarian series stood at 75.6% in 2017, so eight years have brought no real improvement. The 2020 shock is visible in all three countries, most sharply in the Polish sample (from 83.1% to 53.1%), and the recovery since has been gradual. On the Gartner-based scale (category leader above 85%, good 81–85%, above average 77–81%, average 73–77%) most companies in the region sit in the "average" and "below average" bands.

From the respondents' free-text answers the speaker compiled the sources of untapped reserve. Recurring items: an advanced AI/ML-based demand forecasting tool that handles seasonality and external factors (inflation, raw material prices, consumer trends) alongside historical sales; integration of real-time POS and EDI data into the ERP; extending the S&OP process with predictive analytics; building team competencies in data analysis and model interpretation; automating reporting and BI dashboards; improving the quality of input data (sales, inventory and promotion data). Several respondents quantified the expected effect: a 7–8% gain from more accurate forecasts plus a further 2–3% from partners who do not cooperate today; a reserve of around 10% from predictive analytics; elsewhere only a 1–2% gain seems realistic, because the customer portfolio and long lead times limit the return on deeper analysis. Two proposals were organisational rather than technical: writing forecast accuracy into the bonus scheme of sales managers, and continuously comparing the demand forecast with the marginal cost of production.

The review of development activities in 2019–2024 showed respondents reacting to changing external conditions with training, restructuring of the planning organisation, group-level forecasting structures, the introduction of machine learning and ABC/XYZ segmentation, and the alignment of portfolio, forecast, inventory policy and production.

Structure of the curriculum (module map)

The main product of the project is a three-module curriculum, underpinned by the comprehensive WP1 survey report. Module 1 (Integrating traditional and advanced forecasting methods / A systems view of forecasting) covers, in four chapters, the concept of forecasting and the lessons of the surveys, the sources of inaccuracy, preparatory analyses, and qualitative and quantitative methods. Module 2 (Support for forecasting) has five chapters: SCM and inventory-management links, forecasting and evaluation algorithms, BI and CRM functions, the role of the demand planner, and auditing and developing forecasting culture. Module 3 (Advanced forecasting environment) has three chapters on software solutions (Excel, SPSS, SAS), predictive techniques for reducing losses, and machine learning in short-term forecasting. The modules come with Excel worked examples (tracking signal, ARIMA, SVR, neural network), timing plans and checklists.

The speaker also presented the version map: alongside the Hungarian (GTE) master, the Częstochowa and Trnava partners produced their own locally adapted versions from the same chapter structure, so the curriculum runs in three countries in parallel on a single backbone.

Possible project outputs

The presentation closed with four exploitation routes: university teaching material (with a follow-on data-scientist track), training for industry delivered in parts or as a whole, and short- and long-term consultation on forecasting questions. During the domestic roll-out to date, 144 participants (101 students, 43 professionals and lecturers) at eight events have worked with the material.

3. The Polish perspective – Częstochowa University of Technology (Robert Ulewicz, Manuela Ingaldi)

The Polish partner's presentation, "From Forecasting Challenges to Forecasting Maturity", reviewed the forecasting challenges, development opportunities and training needs of Polish companies. Częstochowa University of Technology has seven faculties (including Management, and Computer Science and Artificial Intelligence) and around 620 academic staff; the project is run by the Faculty of Management.

The starting point: the V4 countries share forecasting obstacles but operate in distinct business ecosystems. The Polish market is especially diverse in industries, company sizes and levels of digital maturity. The true drivers of forecasting growth are not method selection but process integration, data quality and team

competencies together. The key question: how can organisations move from experience-based forecasting towards integrated, data-driven decision-making?

The business context is shaped by changing energy and raw-material costs, market volatility, inflation and changing customer behaviour, dependence on international supply chains, and at the same time the growing availability of digital data and analytical tools and pressure to cut inventories and raise efficiency. Five factors make forecasting difficult: volatile demand, fragmented data (isolated analysis), limited integration (departmental silos), competency gaps and slow, reactive response. The speakers stressed that accurate forecasting requires more than selecting an appropriate method: forecast quality depends on the interaction between people, processes, data and technology.

Maturity framework

The Polish partner proposed a five-level forecasting maturity model: (1) reactive – irregular forecasting based on experience and intuition; (2) structured – regular forecasts and historical data analysis; (3) integrated – cross-functional planning, ERP and S&OP; (4) data-driven – integrated data, BI and predictive analytics; (5) intelligent – AI/ML, dynamic updates and scenario-based decisions. The development path runs from experience and intuition → Excel-based analysis → integrated data and BI → predictive analytics → AI-supported forecasting; the objective is not to replace managerial experience but to strengthen decisions through better data and analysis. Maturity rests on four foundations – people, processes, data, technology – and develops only when all four evolve together.

Forecasting culture is more than forecast accuracy: who prepares and approves the forecast, whether the process is collaborative and cross-functional, how errors are analysed and discussed, whether forecasts are linked to operational and strategic decisions, and whether employees have the competencies to interpret data and models. Different industries face different challenges: manufacturing focuses on production planning and capacity utilisation, FMCG battles seasonality, promotions and short product lifecycles, construction and materials are tied to macroeconomic cycles and energy costs, retail and e-commerce manage rapid demand swings and massive customer data streams. One forecasting method does not fit every organisation.

Training needs and the project's contribution

The Polish reading of the three modules: Module 1 aims at selecting and applying the right mathematical models to real business scenarios; Module 2 at embedding forecasting into SCM, inventory management, BI and CRM systems; Module 3 at building digital maturity through predictive analytics and machine learning. The blueprint for effective training is the LEARN → ANALYSE → FORECAST → EVALUATE → IMPROVE cycle: real case studies on actual historical data, error analysis (shifting the focus from accuracy alone to dissecting mistakes), scenario planning under high uncertainty, and hands-on practice with modern BI and applied AI tools. As an example, a typical development path was shown: high forecast errors causing excess inventory and inflated operating costs; fragmented data, communication silos and reactive planning as likely causes; and as actions, improving the quality and integration of input data, introducing regular cross-functional planning, measuring and analysing accuracy, developing employee competencies and using BI and predictive tools where appropriate.

The presentation closed with four messages: improving forecasts requires an organisational cultural shift, not just new IT tools; maximum value is unlocked at the intersection of people, processes and data; growth paths must be aligned with the company's current maturity level; and the project builds a bridge between university research and enterprise practice. Better forecasting supports better decisions in an uncertain future.

4. Forecasting in intelligent manufacturing – Slovak University of Technology, Trnava (Peter Košťál, Vanessa Prajová)

The Slovak partner presented the curriculum from the viewpoint of intelligent manufacturing, with two worked problems. The starting point was the five years that broke planning: the pandemic halted production and transport, war and the energy crisis reshaped input prices, supply-chain pressure peaked in 2021 at a level not seen since the 2008 crisis, lead times stopped being predictable, and planning horizons shrank from months to weeks.

A forecast error shows up physically on the shop floor: storage full of parts for orders that never came, one missing item stopping the whole line, expedited transport at several times the normal cost (air freight up to ten times sea freight), planning meetings without a shared basis, and reviews that cannot say how far off the forecast was. The speakers' thesis: the gap is in education, not in tools. Forecasting tools are available and affordable – 85% of large manufacturers run an ERP with a forecasting module – yet fewer than one planner in five has any formal forecasting training; planners learn on the job, from their own errors, and the employer pays for those errors.

Why automation is less forgiving

In intelligent manufacturing the forecast is a direct input to automated decisions: it feeds the production plan, the plan sets batch sizes and sequence, replenishment rules follow from the plan, and the storage system executes without review. A planner notices a wrong number and stops; an automated system executes it immediately, the error propagates before anyone sees it, and the correction arrives one planning cycle late. The same error costs more when nobody checks: a 10% forecast error can turn into 20% excess inventory or a stock-out.

The economics of accuracy are non-linear: forecast error drives safety stock and service level drives tied-up capital; at 95% service level the safety factor is 1.64 standard deviations, at 99.9% it is 3.09 – the last few percentage points triple the safety stock, and the bullwhip effect amplifies the variability upstream. Method choice follows the data pattern, not software popularity: trend and seasonality call for different methods, intermittent demand has its own family (e.g. Croston), and machine learning is one option among many – for a series of thirty periods, simple exponential smoothing is more robust. In measuring error, one number is never enough: magnitude (MAD, MAPE, RMSE) and direction (mean forecast error, tracking signal) must be read together, and systematic bias is more dangerous than noise. Data sources (ERP, CRM, BI, shop-floor signals, customer POS data) differ in freshness and horizon; a forecast is only as good as the data that feeds it. The curriculum's five-dimension maturity audit (data, model, process, people, technology) produces a score and an improvement roadmap, and in the speakers' view is the most actionable output.

Two worked problems

Task 1 – forecast the thirteenth month. Twelve months of demand for one component from an automotive supplier grow steadily (from 100 to 160). The naive method gives 160, the three-period moving average 155, simple exponential smoothing ($\alpha = 0.3$) roughly 140. The actual value was 165: all three methods came out too low, and the more a method smoothed, the worse it did – the simplest method won. Lesson: a trended series needs a method that models the trend (Holt, regression); smoothing alone creates a systematic lag.

Task 2 – which item deserves the effort? Of two items with the same annual turnover, one is forecast well and the other poorly, and time to improve the process is limited. Forecast error sets the safety stock, safety stock converts into storage slots, and slots are a scarce resource in automated systems (safety stock = $z \cdot \sigma \cdot \sqrt{L}$; at 95% service level and an error standard deviation of 100 units, 165 units, or 33 slots of 5 units). The same 10% relative improvement frees two to three times as many slots on the poorly forecast item as on the well-forecast one. Lesson: effort follows the size of the error; do not invest where it already works.

Using the materials

The material is modular: a full 14-week semester course (two hours of lectures plus a lab session per week), a six-hour concentrated block for industry, modular company training on demand, or self-study with the appendices (data sets, Excel templates, code examples) and references. The audit questionnaire can be used on its own. The materials are open to non-partner institutions under a Creative Commons licence.

5. Outlook – visions of the future and the role of the demand planner (János Mondovics, GTE; Mondovics János's preliminary and unofficial assessment and proposal. Any consideration or further development of this proposal may be initiated after the completion of the project; it does not form part of the original scope of the project)

The closing presentation positioned the project beyond the curriculum. The opening question: how does the role of the demand planner change in the age of artificial intelligence, and what will distinguish successful demand-planning organisations over the next five years? This is no longer training but professional debate – training is only one of its consequences.

Demand planning as a management function

The speaker's thesis is that demand planning is not a statistical task but a corporate management function, and forecasting will be less and less an end in itself. What matters to management is not that next month's demand will be 12,842 units, but what to do if it is: how much stock is needed, whether overtime is required, whether supplier capacity will suffice, what happens to cash flow and profit, and what happens if the forecast is 10% off. That is decision support, not mere forecasting. Two companies can have the same MAPE, say 18%, and one can be far more successful because it builds the forecast into decision-making – through simulation, scenarios, risk analysis, S&OP/IBP processes and management dashboards – while at the other the same figure remains a KPI. This suggests a research direction: measuring the value of forecasting not through accuracy but through the quality of decisions, going beyond the Forecast Value Added approach.

Three generations of the demand planner

Over the next five to ten years the role is expected to pass through three stages. Generation 1, the Forecast Producer (the past), builds forecasts in Excel with statistical models and error metrics and answers the question: how large will demand be? Generation 2, the Business Integrator (the present), links S&OP, BI, ERP, CRM, marketing, production and finance and asks: why will demand be this large? Generation 3, the AI Orchestrator (the future), supervises AI models, selects models, uses Explainable AI and digital twins, manages risk and supports business decisions; its question: what should we do under different futures? This is no longer forecasting but decision intelligence.

New initiatives

The speaker announced three initiatives that build on each other. The European Roundtable is an international professional debate on how AI changes the demand planner's role, seeking experienced practitioners to help shape the next generation of demand-planning education. Companies do not guard their forecasts but their decision mechanisms – MAPE, accuracy, stock-outs and profit are business secrets – so the "gift" of the workshop is a Demand Planning Self Assessment: twenty questions in ten minutes, a radar chart and a maturity level; not an audit, not consulting, not a rating, but a self-assessment.

The European Demand Planning Observatory (EDPO) is not a project but a continuous professional workshop: a regularly repeated international survey that can yield a European Demand Planning Report, a Demand Planner Salary & Career Report, an AI Adoption Report, a Competency Report and a University Benchmark Report. The objective is the first long-term European benchmark on demand-planning capability; within a few

years it could become a reference point comparable to Gartner or APQC in their fields. Participants are invited to the founding workshop as founding members, to help define what the demand planner will need to know in 2030.

The third direction is organising an "AI-based forecasting, optimisation, decision support, industrial networking" programme into a project, initially within a Living Lab. Three demonstrable models emerge that can be built on one another: (1) an AI-based demand forecasting and early-warning model working from historical and external data, comparing traditional and machine-learning methods and delivering a forecast, confidence band, forecast error and risk signal; (2) a forecast-driven production and inventory optimisation model that runs what-if analysis across several demand scenarios, taking capacity, lead time, holding and shortage costs into account; (3) an AI-supported industrial decision-support and knowledge-transfer model that evaluates scenarios on a KPI dashboard by cost, service level, inventory, capacity utilisation and accuracy, and serves as a Living Lab tool in industrial workshops. The logical chain: Forecast → Optimisation → Decision Support → Industrial Demonstration → Knowledge Transfer.

The presentation ended with a closing questionnaire: participants selected, from twelve listed competencies (forecasting, inventory, communication, AI, BI, ERP, S&OP, leadership, scenario planning, data, statistics, business), the five they consider most important for the demand planner in 2030.

6. Main threads of the moderated discussion (any formal initiative related to the future outlook may be launched by the project leader only after the completion of the project)

> *This summary arranges the main threads of the discussion by theme, without attributing contributions to individual participants.*

The first thread concerned the state of forecasting practice in the V4 region. Participants agreed that the figures of the three countries are strikingly similar: accuracy around 73–75% and a Hungarian series that has stagnated for eight years indicate a structural rather than a country-specific problem. The most frequently named causes were fragmented data, the lack of cooperation between sales and planning, and the forecast's "decline into a KPI" – the number gets produced but does not enter decisions. Several participants noted that almost everyone considers collaborative forecasting with customers important, yet few practise it, because partners treat their data as business secrets. The conclusion drawn was that the region's largest reserve lies not in methodology but in process and organisation.

The second thread was the need for education. The Slovak presentation's thesis – the gap is in education, not in tools – met broad agreement: most companies have their ERP and often a BI tool as well, but planners learn the trade on the job, from their own mistakes. In the participants' view forecasting sits at the margin of university curricula, while corporate training teaches tool use rather than a way of thinking. The project curriculum was therefore given a dual role: as a university course, laying the foundation for the next generation; as short corporate blocks, building a common language between working planners and their sales and production managers. Error analysis on real data and the self-assessment questionnaire were singled out as priority needs – several participants saw the latter as something they could try in their own organisations immediately.

The third thread addressed the future role of the demand planner. Participants found the three-generation model realistic, but judged that most companies in the region still sit between the first and second generation, so the "AI Orchestrator" role is meaningful in few organisations for now. There was agreement, though, that artificial intelligence replaces routine work rather than the planner: model building and updating can be automated, while supervising models, interpreting errors, framing scenarios and communicating with management gain in value. Among the 2030 competencies, communication, S&OP and scenario planning

received the most mentions in the discussion alongside forecasting and data skills; the closing questionnaire will be evaluated separately. Participants supported the idea of the European Demand Planning Observatory, with the proviso that the survey should be easy to complete and the data published in aggregate form that cannot be traced back to individual companies.

7. Conclusions and next steps (any formal initiative related to the future outlook may be launched by the project leader only after the completion of the project)

The four presentations pointed in one direction: forecast accuracy in the V4 region has stagnated for years, the reserve lies in processes, competencies and the integration of forecasts into decisions, and the key to improvement is systematic education. The project's three-module curriculum is complete, exists in localised versions in three countries, and can be used in several formats (semester course, six-hour corporate block, self-study, self-assessment questionnaire).

- Finalise and publish the curriculum under a Creative Commons licence, accessible to non-partner institutions; continue the domestic roll-out until project closure in November 2026.
- Finalise the Demand Planning Self Assessment questionnaire and distribute it to workshop participants; feed back the results in aggregate form.
- Prepare the European Roundtable and the founding workshop of the European Demand Planning Observatory; recruit practitioners and founding members through the partners.
- Shape the "AI-based forecasting, optimisation, decision support, industrial networking" Living Lab concept into a project proposal along the three interlocking models, as a continuation of the V4 partnership.
- Evaluate the closing questionnaire (key competencies for 2030) and build the results into the second edition of the curriculum and the agenda of the next workshop.