



True Demand-Driven Semiconductor Supply Chains for Europe

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Lead contractor	Infineon Technologies AG Thomas Gutt, mailto: thomas.gutt@infineon.com	
Deliverable responsible	Involvation BV Alfons Willemsen, a.willemsen@involvation.com	
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Authors

Particip- ant no.	Part. short name	Author name	Chapter(s)
1	INVOLVATION	Alfons Willemsen	all

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Publishable Executive Summary

The overall objective of WP7 is the incentivization of participants in order to participate in the survey and in this way to obtain enough and qualitative good data. The set of participants should in any case consist of companies covering the whole semiconductor supply chain while being sufficiently representative and in sufficient numbers. As a first step (task 7.1) the idea is to create awareness and attract participants in order to build a community of first-time users who provide first data both on demand and supply. Those first-time users should be representative of the semiconductor supply chain including semiconductor manufacturers, Tier 1, Tier 2 and OEMs. This initial awareness creation will be done by gamification of the survey. An MVP of a game is now available (Q4 2025).

This was the original plan for T7.2 as drafted in the project proposal:

Once participants have decided to participate it is important to continuously improve (PDCA) the quality of the surveys filled in by them. This continuous improvement should result in an acceptable quality level of the surveys in order to achieve the overall “true demand” objectives. The intention is to create feedback loops for the participants so they can learn from their surveys and the results. A continuous reinforcement of the original objective and the achieved results hopefully will lead to an increasing overall (and individual) quality level of the surveys. The set of “survey tricks” to be developed will be a combination of different elements. Examples: objective overall results, individual results and scores, longitudinal comparison, competitive comparison (again gamification), challenges, comments, fun facts & figures, certificates, badges, do’s and don’ts, publications, posts, podcasts, etc. Once participants have decided to participate it is important to continuously improve (PDCA) the quality of the surveys filled in by them. This continuous improvement should result in an acceptable quality level of the surveys in order to achieve the overall “true demand” objectives.

During the SC4EU Munich project meeting in January 2025 it became clear that within the scope of the current project only a few actual surveys (both “semi” and OEM) will be executed. This change of perspective forced us to re-think the approach we initially intended, PDCA based on actual (numerous) surveys is not possible. Ofcourse, PDCA will still be used as a general feedback loop and learning cycle but not based an actual numerous surveys from participants.

The main approach now is to use the developed “game”. This game has 3 Echelons: OEM, Tier1 & SEMI. With bots we can create all kind of scenarios and run the game. In this case we can create game based scenarios and can describe the scenarios and also the resulting scoreboards and KPIs.

Developing these scenarios and use cases can and will be used as illustrative examples to warn against bad survey quality and improve the overall survey quality.

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1. Introduction

1.1 Objective and scope of the document

- **Objective:** Give an overview of the current status of the deliverables of WP 7 (Gamification and User Experience Aspects of the Survey)
 - Description of the problem to be solved by the development of the true demand platform as well as the expected outcome
 - The role of incentivization for participation in anonymous survey in order to obtain data
 - A description of the initial plan for T7.2 and the revised plan
 - A status update of the actions taken with regard to the revised plan
- **Scope:** Achieved progress between 1/12/24 and 30/11/25 specifically with regard to task 7.2

1.2 Structure of the deliverable report

- Scope
 - This chapter aims to provide an overview of this project's motivation, objective, the methodology used to tackle this problem, as well as the expected outcome.
- T7.2 initial plan and revised plan
 - This chapter describes the initial plan for T7.2 and the revised plan (as well as the rationale for the revised plan).
- Status update actions revised plan
 - This chapter highlights the actions executed and the next steps.
- Conclusion

2. Scope

The following chapter aims to provide an overview of this project's motivation, objective, the methodology used to tackle this problem, as well as the expected outcome.

2.1 Motivation

The semiconductor industry is highly dynamic and sensitive to fluctuations in demand. The Bullwhip Effect, where small changes in consumer demand cause larger variations in orders up the supply chain, can lead to inefficiencies, overproduction, and panic buying. By using an anonymized demand survey, businesses within the supply chain can gain a clearer picture of the "true demand" leading to more stable and efficient operations.

2.1.1 Problem Statement

The semiconductor supply chain faces significant challenges due to bullwhip effects and panic buying. These issues are exacerbated by the use of different units of measurement across various echelons (e.g., number of chips, number of cars) and the strategic nature of the information. Traditional methods of demand forecasting often fail to capture the nuanced and real-time demand signals needed to mitigate these effects. A second challenge is that the semiconductor industry goes through periods of oversupply and shortages, because capacity is not always exactly in line with demand combined with long lead times in the supply chain. For a good capacity planning it is needed to have a better insight in the development of demand.

2.1.2 Objective and Methodology

The primary objective is to design and implement an anonymized demand survey that captures key leading indicators such as inventory levels and demand. The survey will be tailored to address the specific needs of different echelons within the supply chain, ensuring that the data collected is both relevant and actionable.

Survey Design: Develop the survey questions, focusing on inventory levels, demand and demand forecast, and technology node categories. Ensure that the questions are designed to be easily understood and answered by all participants.

The overall objective of WP7 is the incentivisation of participants in order to participate in the survey and in this way to obtain enough and qualitative good data. The set of participants should in any case consist of companies covering the whole semiconductor supply chain while being sufficiently representative and in sufficient numbers (text from call). As a first step (task 7.1) the idea is to create awareness and attract participants in order to build a community of first-time users who provide first data both on demand and supply. Those first-time users should be representative of the semiconductor supply chain including semiconductor manufacturers, Tier 1, Tier 2 and OEMs (text from call). This initial awareness creation will be done by gamification of the survey.

2.1.3 Expected Outcome

The project aims to develop a comprehensive demand survey that can be used across the semiconductor supply chain to accurately gauge true demand. This will help in reducing the bullwhip effect, preventing panic buying, and ensuring a more stable allocation of resources across different market segments and technology node categories.

The overall objective of WP7 is the incentivisation of participants to participate in the survey and in this way to obtain enough and qualitative good data.

3. A description of the initial plan for T7.2 and the revised plan

3.1 Progress in Review Period 1 and begin 2025

Progress on the overall WP7 had been limited in the first year of the project. There is a strong dependency on the progress in WP5. Clear definition of the survey, its target audience and USPs are first needed. Late 2024 a couple of decisions had been made in WP5 for the “semi” survey.

In the first half of 2025 the “semi” survey questions were finalized within WP5. It was decided to cover the survey’s questions demand with the future sales & marketing forecasts, inventory, and order cancellations, with a focus on technology nodes as dimension for the question. Next steps of WP5 is finishing the definition of the OEM questionnaire specification and shift the focus then to the Tier1 survey and the transformation graph between the semiconductor products. For the OEM survey the automotive market has been selected.

3.2 Initial plan for T7.2

This was the original plan for T7.2 as drafted in the project proposal:

Once participants have decided to participate it is important to continuously improve (PDCA) the quality of the surveys filled in by them. This continuous improvement should result in an acceptable quality level of the surveys in order to achieve the overall “true demand” objectives.

The intention is to create feedback loops for the participants so they can learn from their surveys and the results. A continuous reinforcement of the original objective and the achieved results hopefully will lead to an increasing overall (and individual) quality level of the surveys. The set of “survey tricks” to be developed will be a combination of different elements. Examples: objective overall results, individual results and scores, longitudinal comparison, competitive comparison (again gamification), challenges, comments, fun facts & figures, certificates, badges, do’s and don’ts, publications, posts, podcasts, etc. Close collaboration will be sought also with work package 8.

The whole assumption underlying this approach was that survey results would become available in the course of RP1 and that an acceleration of available survey results in RP2 would support and feed the approach as described.

However, in the SC4EU Munich project meeting in January 2025 it became clear that within the scope of the current project only a few actual surveys (both “semi” and OEM) will be executed. This change of perspective forced us to re-think the approach we initially intended.

3.3 Revised plan

Because of the fact that only a very limited number of actual survey results would be available during the scope of the project we couldn’t apply our PDCA approach to improving the results of the actual surveys. We decided to change the approach and made a distinction between three different parallel tracks.

3.3.1 Continuous improvement (example WP5 survey)

Late 2024 we developed a “game” for WP5. Late 2024 a couple of decisions had been made in WP5 for the “semi” survey. A “game” has been developed in WP7 to check the definitions made in WP5. This WP5 Survey game was not part of the gamification to motivate participants, but an extra game to support WP5 in defining a clear survey. In addition to the definition of expected future demand the definitions of Technology nodes and market segments were also incorporated in the game.

The conclusions were shared with the WP5 members in Q1 2025. An important observation is that actual forecasting by the “semis” is very short term oriented; long term forecasting is more political and less applicable. Therefore, one of the main conclusions was the need for more participants from companies downstream, closer to the consumer market.

This “survey game” (and the interview with the test users at Infineon, NXP and ASML) therefore already improved the quality of the survey being developed in WP5.

The “survey game” was developed to check the definitions (quote from Survey Design WP5 2.1.2.: “Ensure that the questions are designed to be easily understood and answered by all participants.” and get input for the final decision on baseline. In addition to the definition of expected future demand the definitions of Technology nodes and market segments were also incorporated in the game.

The objectives of this “survey game” were:

- Are definitions clear?
- Is it doable to fill in the requested data?
- Does the output contribute to determine “true demand” (especially after a disruption)?
- Support the choice for one of the baseline options

The “survey game” was excel based and could be played without much training and instruction.

The process consisted of briefing of participants, gameplaying and de-briefing. It was important to get the insights from the participants in order to reflect on the objectives as stipulated.

The participants were nominated in October 2024.

Discussion on profile of participants (from semis and ASML) was important. Deliberately, participants were selected who were not part of the SC⁴EU project team in order to get an unbiased result.

The game that was developed included 3 different options (the baseline options that still needed to be decided upon):

- Baseline scenario 1: Fixed number during the whole game
- Baseline scenario 2: Baseline is recalculated per calendar year, as the average of the 4 quarters of the last calendar year
- Baseline scenario 3: Baseline is recalculated per quarter, as the average of the last 4 quarters

The gameplay was the same for all participants. They all needed to play 6 identical rounds per option.

The game started with a fictitious company with a fictitious forecast.

Information about the fictitious company; market segments and % turnover:

- Automotive 25%
- Power 25%
- IoT 25%
- Security 25%

The rounds of all the three options needed to be played in a consecutive order.

For each round the excel sheet showed a forecast table and a table to be filled in (see Figure 1). In round 4 and 6 big “events/disruptions” were included in the gameplay in order to see the effects on the forecast.

The two fictitious events that were included in the gameplay were:

- Worldwide all subsidies on EVs will be stopped per July 1st,2025. Take this into account in your forecast.
- Due to revival of a pandemic, sales dropped dramatically last month (January)

Assume today is September 1st									
Last month (August 1st) the expected demand has been filled out with these numbers:									
Demand	Baseline (internal Number in units sold)	Current Quarter Q3 2024	Q4 2024	Q1 2025	Q2 2025	Q3 2025	Q4 2025	Q1 2026	Q2 2026
Under 7nm	150	5,0%	3,0%	-2,0%	6,0%	-1,0%	4,0%	2,0%	-3,0%
7nm to <28nm	310	4,0%	-4,0%	2,0%	-8,0%	3,0%	-9,0%	3,0%	1,0%
28nm to <90nm	270	-2,0%	-2,0%	4,0%	3,0%	-5,0%	7,0%	-2,0%	5,0%
90nm to <350nm	250	-9,0%	5,0%	6,0%	-2,0%	3,0%	-3,0%	7,0%	-2,0%
350nm or greater	190	2,0%	4,0%	6,0%	-5,0%	3,0%	-1,0%	7,0%	2,0%
Every percentage refers to the baseline.									
Now there is an update of the expectation for the current quarter (which is Q3 2024) based on the actuals of July and August as shown in the numbers below									
Please enter the new forecast numbers based on the new information of the current quarter									
Demand	Baseline (internal Number in units sold)	Current Quarter Q3 2024	Q4 2024	Q1 2025	Q2 2025	Q3 2025	Q4 2025	Q1 2026	Q2 2026
Under 7nm	150	7,0%							
7nm to <28nm	310	3,0%							
28nm to <90nm	270	-3,0%							
90nm to <350nm	250	-7,0%							
350nm or greater	190	4,0%							

Figure 1: Example of a round of the survey game

The participants were nominated in October 2024 and the intention was to finish the process in November 2024. It took much longer than expected to get nominations for participants. We finally got 5 nominations (2 NXP, 2 Infineon, 1 ASML) and could start with the briefing of the participants beginning of November. The participants played the game in the following weeks. De-briefings were planned end November. Finally the last de-briefing was in December 2024. Analysis of results and final report-out was concluded in January 2025. See figure 2 and 3 with some examples of results from the participants.



Effect of different base line definitions

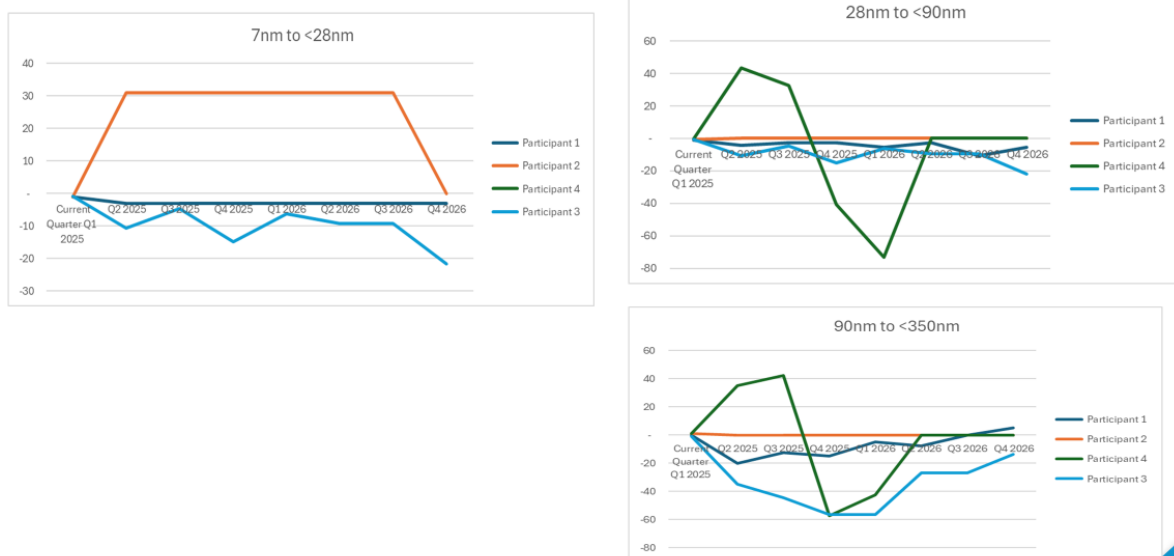


INVOLATION

15

Figure 2: Example of results from participants

Delta from round 3 to 4 (scenario 1)



INVOLATION

16

Figure 3: Second example of results from participants

The four main conclusions (see below) were used within WP5 to improve the surveys.

Conclusions:

1. Determination of forecast numbers as percentages is very complicated. People will always start with a forecast in absolute numbers and then transform these to percentages related to the baseline. This implicates a severe risk in making errors. To avoid these, and to support people in the calculations, we propose to develop a tool which people can use for these calculations. In this tool they should be able to fill in

their own baseline and the forecast in absolute numbers. The outcome of the tool should be the percentages, in a format that can be send easily to the SC4EU platform (in the survey).

2. In the semis the focus of the forecast is very short term: next few months. For the longer horizon, where the SC4EU project is interested in, the semis tend to keep the forecast stable. They won't change the year numbers, implicating that months and quarters are only changed based on realized sales (to keep the whole year stable). For this reason, we don't think it is very valuable to ask semis to fill in a quarterly forecast in a monthly frequency. It won't provide the right information to see a bullwhip.

Note: this is based on the input from demand managers; if we would have participants from semis and ASML from business planning this might give a different perspective (more long term). Crucial again to determine/define the target audience for the survey (from semis and upstream; see also below item 4).

3. The most important and useful information of the surveys will be the difference (the delta) in the numbers between two consecutive surveys. Both for the expected demand (which will be in percentages) and the inventories, which will be in trends (growth / reduction).
4. The most important participants are the companies downstream, close to the consumer market. This is where the true demand effectively shows up.

3.3.2 Game based scenarios and use cases

In the second half of 2025 we developed an online game. We decided to start focusing on developing a game and digital twin/model separate from the further developments of the survey in WP5. The elements of the monthly and yearly surveys for semis, OEM and Tier 1 had been defined and could/would serve as starting points for our game. We worked very closely together with Infineon on developing the game.

The kick-start came from a "basic" game which had been developed internally by Infineon for the SC4EU project. After a demo and playing this game we joined forces and developed the game further.

After we played this initial game we started the development of a couple of parallel tracks:

- Develop a "gameplay" for the game -> strong focus on the WHY (to convince participants to participate in the true demand survey). Staging of the game and tailoring to lessons learned is crucial in this gameplay.
- Improve the functionality of the game (after thorough analysis of the game)
- Create flexibility in the game -> in the end we want to have different "variants" of the same game, to be tailored to target audience (e.g. semi vs tier 1 vs OEM), tailored to personas, individual games vs group games, short vs longer games, individual vs group games, etc.
- Build the game into a "stable" version with back-office functionality in order to play different scenarios
- Etc.

The end result (an MVP version now in Q4 2025) is a flexible game (including visual graphics) now with configurable demand, lead times, starting inventory, back orders and costs (elements of the survey). See figure 4 below (visual representation of the 3 tiers) and figure 5 (role specific statistics). One of the main "learnings" of the game is illustrating the advantage of having "true demand" information and how that impacts decision making.

The game is now available in Vercel and actions can be triggered with JavaScript in a react library. In total the game expanded from appr. 1700 programming lines initially (the code of

the “basic” Infineon game) to 6100 program lines currently (mix of HTML, Python, JavaScript and CSS). One of the most important features is that the game can be played by “humans” or it can be simulated with bots.

This possibility to play the game with humans or simulate scenarios with bots is the breakthrough which we are going to use as a basis for survey tricks. The game has 3 Echelons: OEM, Tier1 & SEMI. With the bots we can create all kind of scenarios and run the game. In this case we can create game based scenarios and can describe the scenarios and also the resulting scoreboards and KPIs. In addition to strategic behavior we can also simulate and reproduce malicious intent as behavior for example.

Here we can also make a distinction between Standard behavior and Strategic behavior (shortage gaming, independent forecasting updates, dynamic adjustment of inventory targets, etc.) which causes efficiencies (see also WP4; system dynamics). Developing these scenarios and use cases can be used as illustrative examples to warn against bad survey quality and improve the overall survey quality.

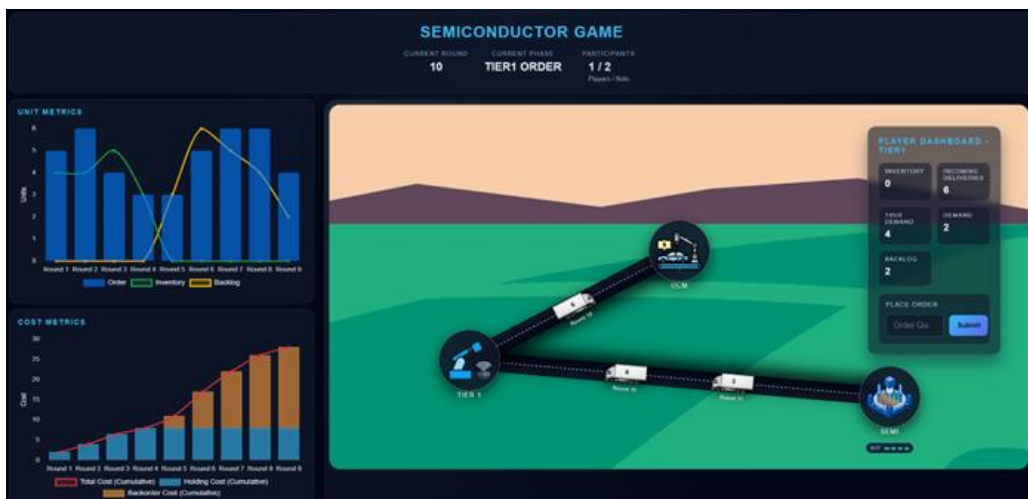


Figure 4: MVP visual representation of the 3 tiers

Role-specific Statistics

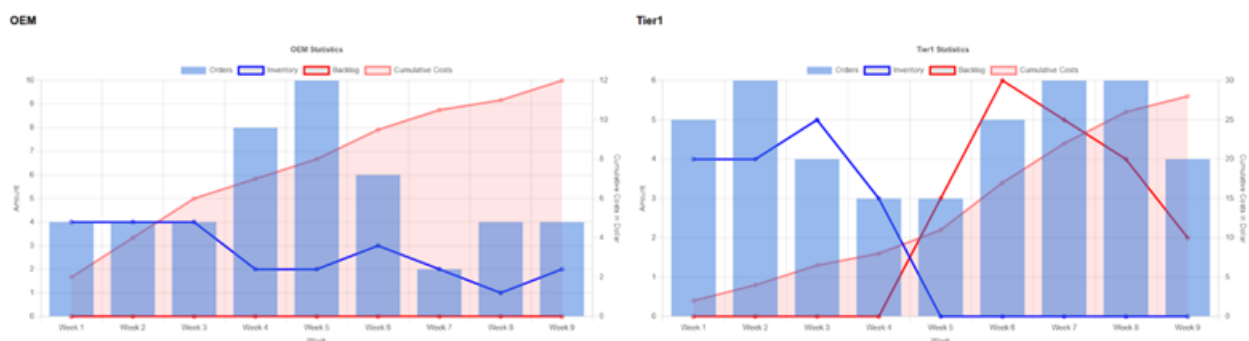


Figure 5: MVP role-specific statistics

3.3.3 Brainstorm on additional survey tricks

In addition to 3.3.2 (which will be the main focus of T7.2) input was gathered from Infineon and NXP on additional “routes” to develop additional “survey tricks”. Some first initial ideas (still need to be screened / ecaluated):

- Manipulation: We intended in the work package survey tricks to also think about how participants can/could trick the survey. Incentives/and proposed solutions should then be mapped to those ways of manipulation (suggestion from IFAG)
- For continuous improvement: working on a proposed process on how continuous improvement (PDCA) looks like later on when the survey is running. E.g. which stakeholders are involved, who is steering this, what responsibilities does the third party have? How are the survey participants involved? How often do we do this continuous improvement cycle? Every year or more often? (suggestion from IFAG)
- Consider other gamification elements for the survey, challenges, figures, certificates can also be done with all the specified survey questions at this point. Objective: create a catalogue / toolbox of tricks that can enhance participation in the survey e.g. think about scoring, badges how can we get people to participate and maybe work as a team to improve forecasts together (suggestion from IFAG)
- Simulation-Based Learning → Create fictional supply chain scenario, where participants see how inaccurate or incomplete data leads to overproduction, stockouts, missed revenue, increased DIO. Let users „play“ with different input qualities and see the simulated outcomes. (suggestion from NXP)
- Collective scoreboard (in the „true demand platform“) → show aggregated survey quality trends over time (e.g. % completeness, consistency). Use visual metaphors like „signal strength“ of demand forecast, „health bar“ of the supply chain, „forecast fog“ (suggestion from NXP).

Similar ideas/suggestions were already gathered also for T7.3:

- Showcase different ways of incentives, e.g. look how others are doing it in surveys and describe pros / cons of each incentivisation method and whether it might have the desired effect to collaborate truthfully in the survey.
- E.g. the following incentive strategies could be explored and analyzed whether they would suit our needs:
 1. Monetary incentives from selling survey results to others (closely linked to WP8)
 2. Getting survey results for free when you participate
 3. Getting access to special tools such as simulation and forecasting models etc. when you participate...
- From the defined incentives, Develop a set of activities on how we can attract users together with WP8 -> decide together with WP5 and 8 what is the way forward for us. We end with a catalogue of incentive strategies as well as proposed set of activities on how we onboard users.
- Instead of showing the effect of poor quality survey inputs, show the gain of accurate survey inputs by providing hints in the game environment (in the form of survey results). Let them forecast, and create challenges for e.g. „Forecast hero of the month“ and add some anecdotes about calculation on how much a company on average can save (suggestion from NXP)

These suggestions will all be evaluated and discussed. As 3.3.2 is the main way forward some of the ideas/suggestions here will be considered when we define “game based” scenarios and use cases as basis for the survey tricks.

4. Status update actions revised plan

4.1 Game based scenarios and use cases

In Review Period 3 the focus will be on 3.3.2, game-based scenarios and use cases. The MVP of the game will be a demonstrator in the RP2 review (see some examples below; figure 6 illustrating the log-in screen and role selection and figure 7 showing the final results after the game). The game will be further fine-tuned and perfected in Q2 2026.

Different game-based scenarios and use cases will be developed. All these developments will be in line with the target audience and persona approach (see overall report RP2). The more scenarios and use cases are tailored, the higher the impact will be. The objective is to develop a “catalogue” of scenarios and use cases which can be used for the different purposes.

Learnings from the internal tests of the surveys (conducted by WP5) will be considered and can also lead to additional/adjusted scenarios and use cases. Some scenarios/use cases can also be used for blogs/articles and can be incorporated in the overall communication “toolbox”.

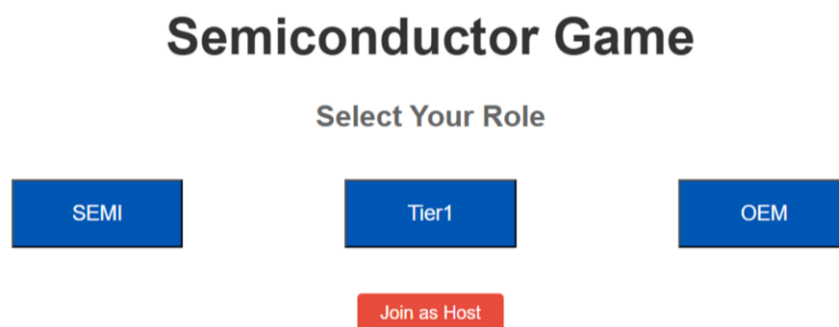


Figure 6: MVP log-in screen of the game -> role selection



Figure 7: MVP final results after the game

4.2 Brainstorm on additional survey tricks

Based on the initial discussion with Infineon and NXP in Q3 2025 next steps will be taken to explore and/or expand the ideas further in 2026.

5. Conclusions

The overall objective of WP7 is the incentivization of participants in order to participate in the survey and in this way to obtain enough and qualitative good data. The set of participants should in any case consist of companies covering the whole semiconductor supply chain while being sufficiently representative and in sufficient numbers. As a first step (task 7.1) the idea is to create awareness and attract participants in order to build a community of first-time users who provide first data both on demand and supply. Those first-time users should be representative of the semiconductor supply chain including semiconductor manufacturers, Tier 1, Tier 2 and OEMs (text from call). This initial awareness creation will be done by gamification of the survey. An MVP of a game is now available (Q4 2025).

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