

Project No.: 147426

Project acronym: TANOCOMP

Leonardo da Vinci Project 2011 – 2013

Work Package 4: Definition of Didactic Content

Result 20: Determination of Target Groups' Needs

Report: Training needs analysis for Small and Medium Enterprises (SMEs) on nANOTEchnology aspects of plastic COMPosites with enhanced properties for use in high-strength applications

Introduction:

The sample of the research consisted out of 92 legal entities. The answers analyzed below refer to the total answers collected and not to the whole sample. However, the graphics show the percentages on the overall sample.

Q2: Please describe the geographical area where your organization is active in. You can select more than one option if necessary:

Approximately half of the sample answered that the geographical area where their company is active in is worldwide, the ¼ European and the 1/5 national. This means that it is easy to create a common learning program in order to educate employees to use nanotechnology.

Q3: How many employees has your company/ how many members does your organization have.

45% answered that there are from zero to fifty employees in their company and 26% answered that there are from 51 to 250 employees. Consequently, the research is focused on SMEs.

Number of employees:	Number of Companies
0--50	17
50--250	2
250--1000	7
1000+	4

Q4: Does your company have an RTD (Research Technology & Development) department?

50% answered that their company/member has an RTD department, but almost 30% answered that they do not have one. This is a huge problem, considering that the learning program for employees in order to introduce nanotechnology in the plastic field is only the beginning. An RTD department is necessary for continuing the necessary efforts so as to use nanotechnology in plastics production.

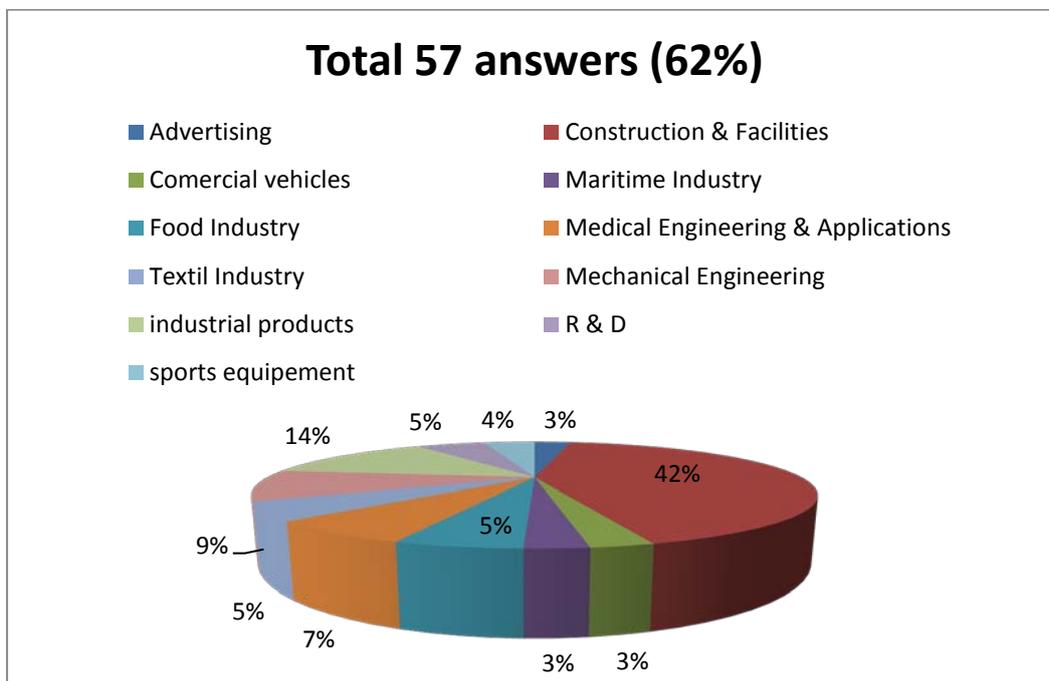
Q5: Please specify in which sector of the production cycle your members/company are focused on.

The organizations and companies asked are focused on plastic processing at about 70% and on plastic compounding approximately by 23%. As a result, the importance of the learning program should be given to those two sectors.

Q6: Please specify the application sector your members/company work in

48% answered that their members/company works on automotive and the 30% on aeronautics while the 40% on packaging and household. Therefore the learning program should focus on those application sectors and also to construction and facilities, because according to the other answers (62%), construction and facilities (51%), mechanical engineering (11%) and industrial products (16%) are the main sectors were companies work on.

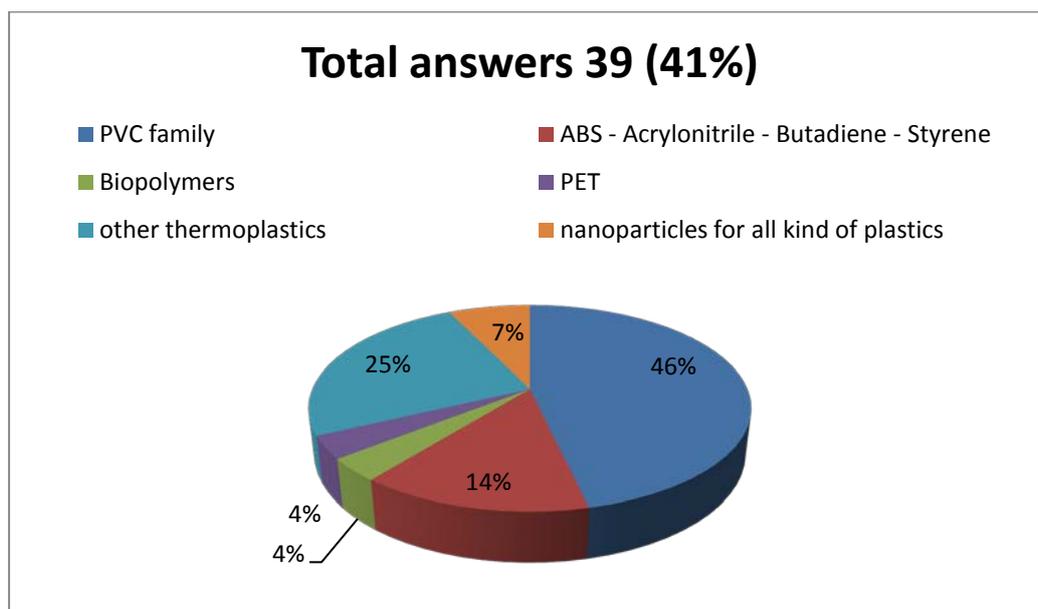
The overall percentages are depicted in the chart below:



Q7: Please indicate what kind of plastic your company is producing or processing.

57% have chosen Polyethylene (PE) as a producing plastic of its company, 55% Polypropylene (PP), 50% Polycarbonate (PC), 43% Polyamide (NYLON), 30% Polyurethane and 23% epoxy resin. All the other kind of plastics (that have chosen the 41% of the answerers) are: PVC family (32%), ABS-Acrylonitrile-Butadiene-Styrene, Biopolymers and PET (16%), other thermoplastics (16%) and nanoparticles for all kind of plastics (5%). In conclusion, importance should be given to PE, PP, PC, Polyamide, Polyurethane, epoxy resin and the PVC family.

The overall percentages are depicted in the chart below:



Q8: Please indicate the three main plastic products your company produces.

Between all answers, there was no connection at all. It is not possible to group the answers, due to the great disparity in the variety of the production activity of the companies.

The overall products are listed below:

Product 1	Product 2	Product 3
TPS-THERMOFLE	PTS-CREAMID	PTS-CREALEN
connectors	security boxes	sensors
vacuum cups	slip resistant feet	light switches
case parts	supporting parts	case parts
decor parts	paddock plates	case parts for mobile phones
actuators for electronic fixing brakes in automobiles	inhaler systems with mechanical counting mechanism for asthmatics	filters
non-woven fabric	household products	oil deflectors oil intake pipes, oil planes, oil return
compounds of biopolymers	fan wheels	PC-foils and panels
slide and tesnsioung rails	ABS/PMMA panels for various applications	under body panelling
technical textiles	spare wheel recess	hard PVC dryblend
furniture oil	PALCOLEN (PP/Talk compound)	parts for container
front-ends	hard PVC granulate	adhesives
CNT-Masterbratches and	parts for electronic coil formers	promotional gifts

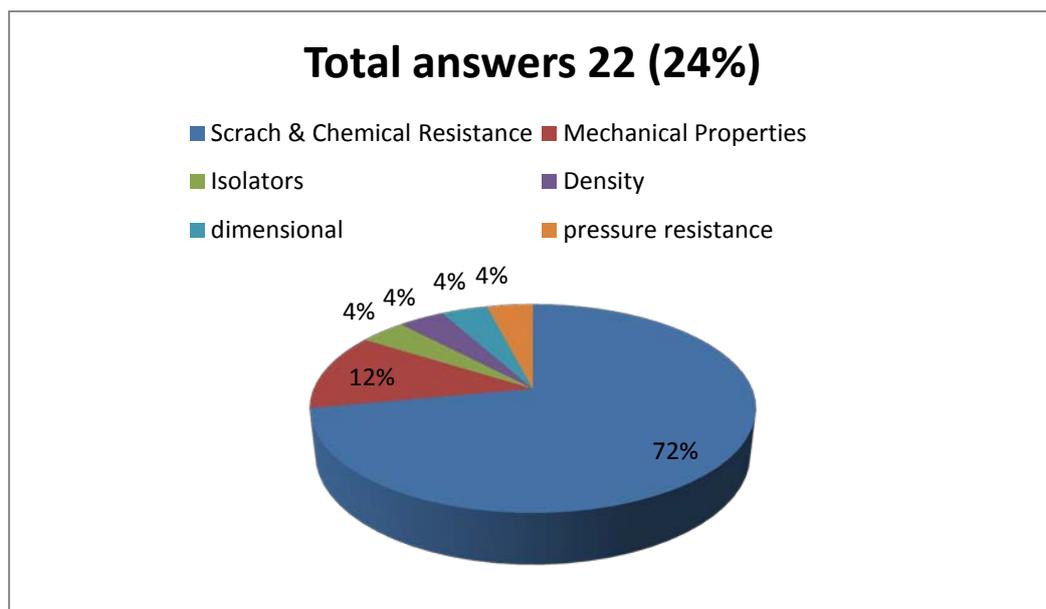
compounds		
soft PVC-granulate	resins	films for agricultural use
components for control and regulator valve	fruit packing trays	flower pots
medium-sized casing parts	food hard packaging	stripes
small-sized casing parts	membranes	winding wires
coatings	parts for tanks	membranes
industrial lighting parts	lighting profiles	building construction materials
cylindrical products of fiberglass and carbon fibers	plastic and rudder compounds	polycarbonate pipe
packaging films	shades	water supply and piping systems
plastic bags	covers	models
hose of irrigation	psedoseiling cover	disposable cutlery, napkins and aluminium trays
PVC profiles	fitting for building industry	conduits
tanks for water and heating oil	irrigation systems	solar collectors
acrylic tubes	mega constuction system incorporating mechanism, motors, gears, pulleys, robotics	filters
cables	machined parts	pedal cubes, hermetics management boxes
covers	injection-moulded buckets	appliance, package
plastic parts	tubes	
acrylic cover	kayaks	
PVC Drainage Pipes	water tanks	
cultivation of flowers	industrial basins	
hybrid construction toys	functional parts	
moulds-tools	moulds for forming	
thermoformed cups and lids	automotive parts	
plastic pipes	Aeronautics aerodynamic parts	
water and diesel tanks	Accessories PVC-U water drainage with anti-noise properties	
dashboards		
containers		
interior coatings		
tubes		
Medium and small size parts to Automotive		
wind blades		
Sealing systems for		

automobiles		
Motorcycle fairings		
Parts made from engineering polymers		
Automotive interior parts		
Plastic containers		
Film of various thicknesses and widths		
Mini and micropart		
Accessories PVC-U water drainage		
compartment interior car parts		
precision parts for electronic devices		

Q9: Please specify the specific properties your products have to fulfill

Importance should be given to mechanical properties (34%), surface quality (54%), high-strength (48%), wear resistance (46%) and electrical and thermal conductivity (37%). According to other properties (which have chosen 29% of the employees), important seems to be scratch and chemical resistance (72%), mechanical properties, isolators, density, dimensional and pressure resistance (32%).

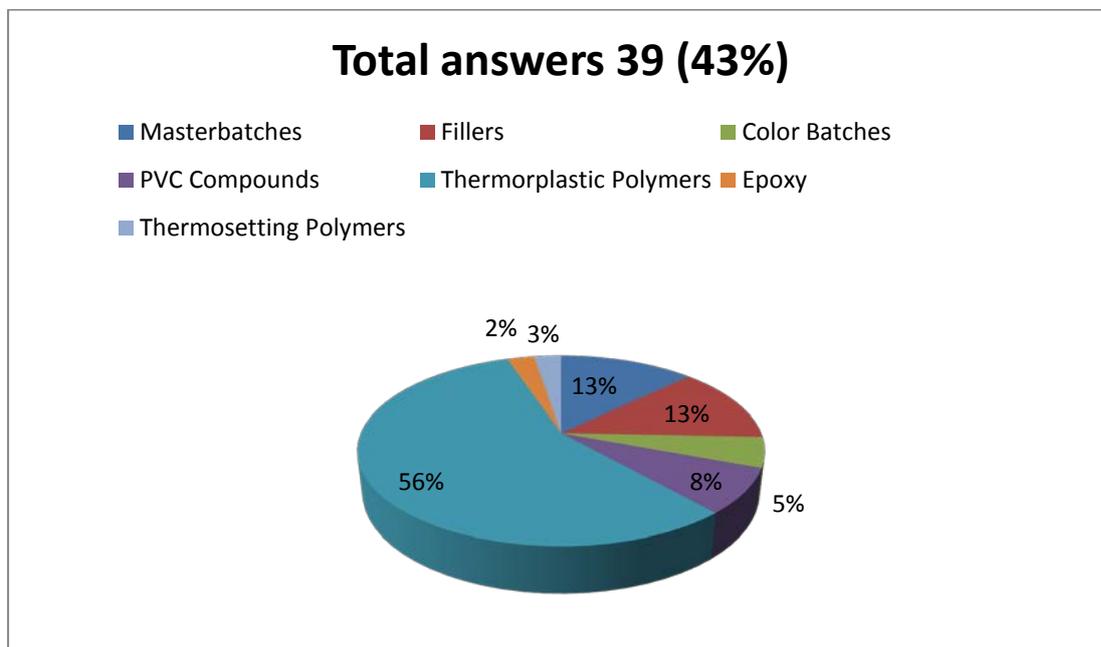
The overall percentages are depicted in the chart below:



Q10: Have you developed any compounds modified with specified additives

43% have already developed some compounds modified with specified additives and 26% have not. This might be a problem because of the inexperience of such a big amount of employees. According to the answers they have chosen “yes” (43%), 51% of them have answered thermoplastic polymers, 26% masterbatches and fillers and 18% color batches, PVC compounds, epoxy and thermosetting polymers.

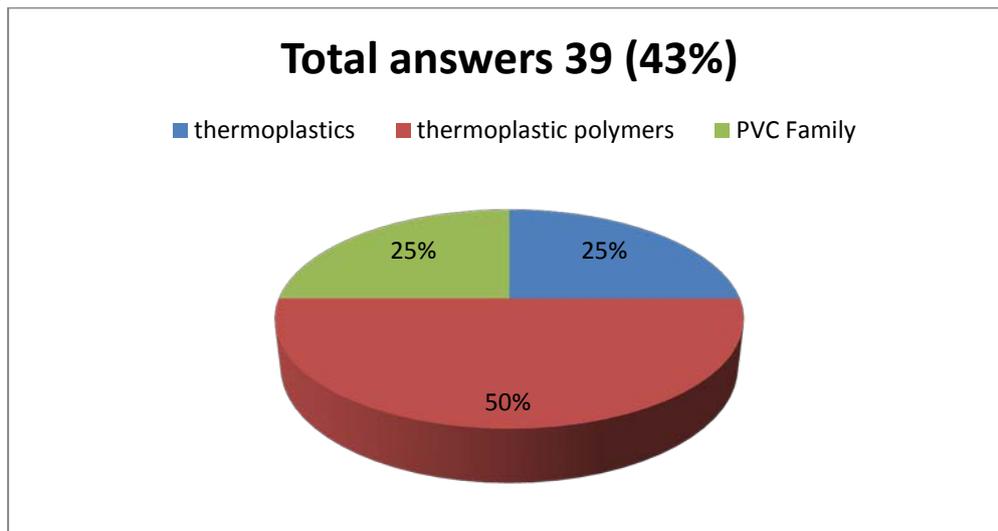
The overall percentages are depicted in the chart below:



Q11: Please specify the types of plastics you have modified with.

60% have already worked with polyethylene; polypropylene and polyurethane while almost 40% with others. Here we could highlight the most used working plastics (43% have chosen “other”), which are thermoplastic polymers (23%), PVC family and thermoplastics (26%). The rest of the companies are using diverse non-categorize-able types of plastic.

The overall percentages are depicted in the chart below:



Q12: Please specify the types of plastics you would be interested to modify.

Most types of plastic to work with are PVC and thermoplastics. Other answers mention as well different types of thermoplastic materials. The second has been already developed by a big amount of employees in their companies. This may mean that having worked with a type of plastic it seems more attractive for further development. So, the learning program should first of all inform employees for a variety subjects, such as nanotechnology and its use.

Q13: Are you aware of any potential application of nanotechnology in the plastics sector

Almost half of answerers claim that companies/organizations are aware of some potential applications of nanotechnology in plastic sector and almost the other half that they don't. This is a big deficit because of the lack of information which may lead to non-interesting employees of learning the use of nanotechnology.

Q14: How familiar are you with the benefits of nanocomposites used in plastics?

In this question, only 4% answered that they are very familiar, 40% that they are just familiar and 40% that are not familiar at all. As a conclusion, the learning program should focus on benefits of nanotechnology, due to getting interesting by the employees.

Q15: From which kind of information sources have you learnt about nanocomposites? You can select more than one answer if needed

Concerning the source of getting information about nanotechnology, 24% answered that they got information through technical/ specialized literature, 10% through participation in survey/studies (none of them was neither German nor Greek), 25% through contact with other companies, organizations or professionals (none of them was neither Greek nor Cypriot) and 26% through internet research, while 25% answered something else. Thus, it seems very useful to create a site that anyone with a username and password could have access, were everyone could find information about the use of nanotechnology in the plastic sector. Also, specialized books (it is better to be in CDs because of the lower cost) can be shared.

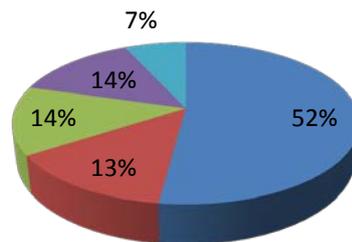
Q16: Please indicate the main reason(s) why nanocomposites have not been integrated or are not being integrated anymore into your existing products. You can select more than one option if needed.

The main reason(s) why nanocomposites have not been integrated or are not being integrated anymore into the existing products of the companies are: first it is rather difficult to find any suitable information or training possibilities on the use of nanocomposites (35%), second in the company there is no RTD infrastructure towards the development of new processing/production methods (17%), third the use of nanoparticles is too expensive (15%) and fourth the lack of seeing any advantage of the use of nanocomposites (7%). Other causes brought up (13%) are production limitations (17%), lack in demand quality (17%), the opinion that nanotechnology doesn't required for costumers (9%) and last but not least that answerers work in a University and not in a company (17%). As we can see, if in the learning program contains information about the use of nanotechnology and training models that can be implemented in companies or in cooperation with more than one company and if it contains theoretical and practical models in order to have the possibility to develop new processing methods, nanotechnology will be useful to much more companies than it is right now.

The overall percentages are depicted in the chart below:

Total answers 19 (20%)

- Other
- Production Limitations
- Lack in Demand Quality
- the company is a University
- nanotechnology doesn't required for costumers



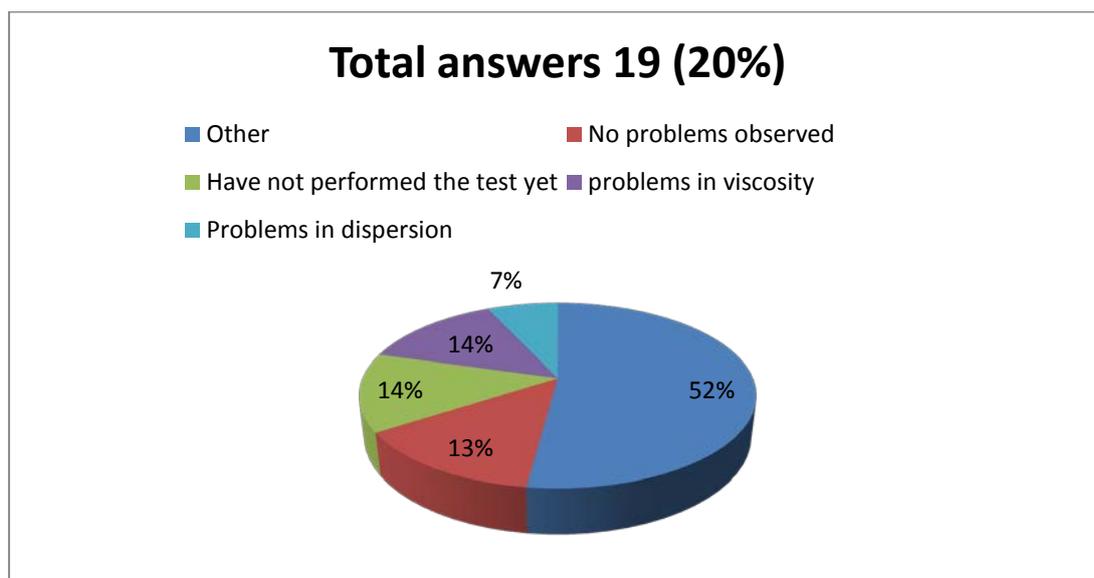
Q17: Which benefits do you expect from the use of nanocomposites?

From the answers given it seems to be a positive perspective of view about the benefits from the use of nanocomposites in plastics. Specifically, 65% claimed that they expect benefits for the customer, 66% competitive advantages, 54% financial benefits, 47% potential to increase market shares, 45% access to new markets, 35% potential to attract new recourses and know-how and 10% have answered something else. This may seems strange because 40% are not familiar at all with the benefits of nanocomposites used in plastics.

Q18: Please indicate any problems you may have encountered during the materials processing with nanocomposites

Problems that employees have encountered during the materials processing with nanocomposites were nanoparticles agglomeration (8%) and that they have not performed the test yet. Also there have been detected (13%) problems in viscosity (15%) and in dispersion (15%).

The overall percentages are depicted in the chart below:



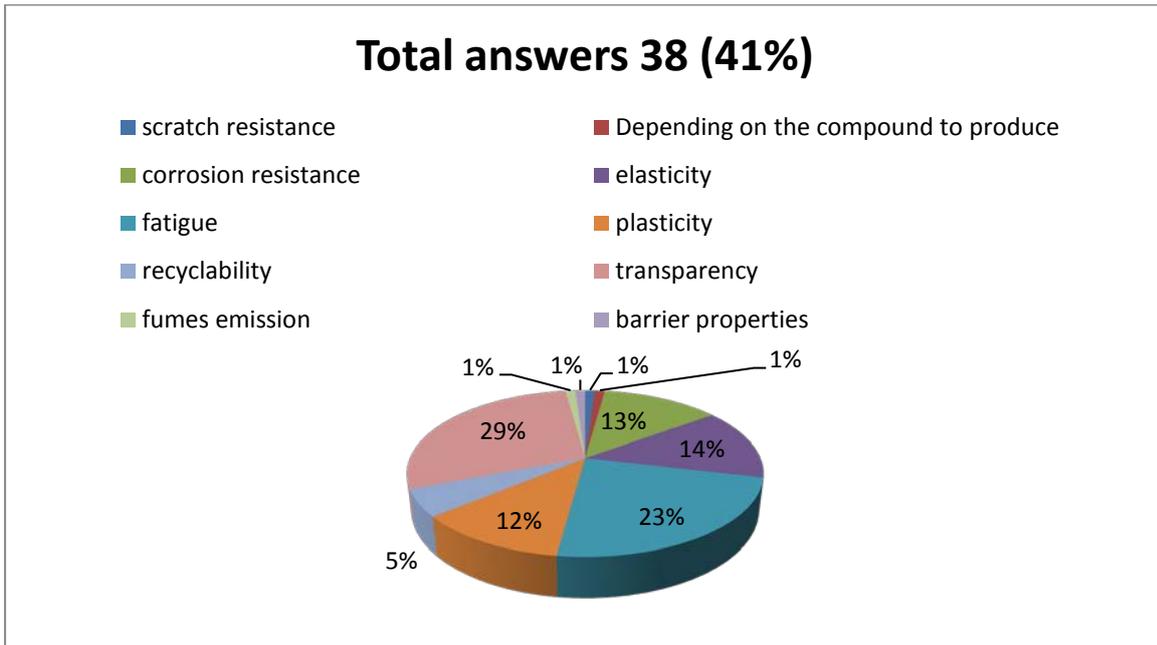
Q19: Would you be interested in the production of thermoplastic composites reinforced with nanostructured carbon for structural or other type of applications?

Almost 40% claim that they are interested in the production of thermoplastic composites reinforced with nanostructured carbon for structural or other type of applications, 8% say that they have already experience and 4% that they are not interested at all. Therefore, we can tell for certain that there is a strong background for the learning program about introducing nanotechnology in the plastic sector.

Q20: What are the most important properties you aim at improving in your products by using nanocomposites?

The most important properties employees aim to improve in their products by using nanocomposites are high-strength (50%), electrical and thermal conductivity (55%) and surface quality (27%). Moreover, (41%) have answered that the most important properties they aim at improving in their products by using nanocomposites are transparency (66%) and fatigue (53%). Others have also chosen elasticity (32%), corrosion resistance (29%), plasticity (26%) and recyclability (13%).

The overall percentages are depicted in the chart below:



Q21: Has your company implemented any measure to favor the introduction of nanocomposites

Concerning the implementation of companies about any measure to favor the introduction of nanocomposites, 35% answered that their company has not taken any measure while 23% claim that their company has and 12% that it has been partially taken some measure.

Q22: Please specify the initiatives your company has implemented to support the use of nanocomposites

About the initiatives that companies have implemented to support the use of nanocomposites, 26% claim that the main implementation is contact with other enterprises related to nanotechnology field and 22% that it is the participation in informative conferences. The learning program could suggest an exchange of employees from companies that already have embodied nanotechnology to their product cycle to companies that they haven't and vice versa.

Q23: From the following list of measures to favor the use of nanocomposites, please evaluate the potential level of usefulness to your company:

Concerning the measures to favor the use of nanocomposites, about specialization through in house training 47% claim it is useful, 22% very useful, 13% fairly useful and 3% not useful at all. About

attending seminars and scientific conferences 53% claim that they are useful, 16% very useful, 14% fairly useful and 1% not useful at all. About specialization through on line training 47% claim that it is useful, 25% fairly useful, 11% very useful and 2% not useful at all. About hiring specialized consultants 33% think that it is useful, 23% fairly useful, 11% very useful and 8% not useful at all. Finally about the establishment of R&D department 37% thinks that it is useful, 23% very useful, 17% fairly useful and 3% not useful at all. As we can see, all measures are positively treated. Therefore, all of them should promote via the learning program.

Q24: To what extent do you consider that the implementation of certification programmes (like quality standards such as ISO 9001) would facilitate the introduction of nanocomposites?

About the facilitation of introduction of nanocomposites using the implementation or certification programs (like quality standards as ISO 9001) 38% believe that it will be very likely facilitate it, 30% that this is a minor issue, 11% that it will definitely facilitate it and 7% that it is not important at all. As a result, the learning program should focus on transferring the idea that the use of implementation or certification programs would facilitate the introduction of nanocomposites.

Q25: Please rate the level of implementation of the following list of statements according to your human resources policy.

Concerning the level of implementation according to each company's human resources policy, about the statement "employees are encouraged to develop their own competences" 38% answered that it is fully implemented, 30% partially implemented and 1% not implemented at all. About the statement "incentive plans for career development are in place" 32% claim it is partially implemented, 21% fully implemented and 13% not implemented at all. About the statement "periodic analyses to evaluate employees' training needs exist" 38% believe that it is fully implemented, 24% partially implemented and 8% not implemented at all. Finally, about the statement "training courses are foreseen for employees" 37% believe it is fully implemented, 14% partially and 8% not implemented at all. Therefore, the HRM department of each company seems to be very efficient.

Q26: From the list of measures listed below, aimed at favoring the implementation and use of nanocomposites, please evaluate the level of usefulness to your company:

Concerning the evaluation of the level of usefulness to each company while answerers already aimed at favoring the implementation and use of nanocomposites, about participation in specific training courses with teaching staff experienced in this topic 49% think that it is useful, 27% very useful and 10% fairly useful. About having didactical material to be used for continuous self-training 42% think it is useful, 26% fairly useful and 17% very useful. About having a tutor or mentor able to help the company about the training needs, times, etc. 42% claim it is useful, 24% fairly useful and 14% very useful. About knowing the results of studies, analyses and researches realized by others, on this topic 43% think it is useful, 26% very useful and 13% fairly useful. About the exchange of experiences with others in own country and abroad (best practice sharing, success stories) 47% claim that it is useful, 33% very useful and 5% fairly useful. About participating in platforms or associations related to this subject 47% believe that it is useful, 21% very useful and 16% fairly useful. About the continuous tool and information mix (internet sites, scientific articles, etc.) 32% think it is fairly useful, 29% useful and 23% very useful. About e-Learning 24% claim that it is useful, 20% fairly useful and 10% very useful. About on-site training 35% think it is useful, 10% very useful and 4% fairly useful.

Conclusions

Out of a sample of 92 organizations and SME's established in Germany, Spain, Greece and Cyprus active in the field of plastic processing and plastic compounding the TANOCOMP partners collected all the necessary information in order to define the training needs of the stakeholders in order to provide the best possible training course in the use of nanotechnology to those involved in the production of plastics. Taking into consideration the technological improvement differences between the countries, the consortium has analyzed the data in such a ways that all countries could benefit the most from the courses. Most organizations participating in the stakeholder's network work on automotive, aeronautics and packaging and household. The plastics used by the majority of the involved organizations in the survey are PVC, ABS-Acrylonitrile-Butadiene-Styrene, Biopolymers, PET and other thermoplastics while the majority of companies are using more than one component.

In general, only the 50% of the asked organizations own an RTD department, a first difficulty that TANOCOMP has to confront as RTD department is necessary for continuing the efforts in using nanotechnology for producing plastics. However, all the organizations have admitted that attention must be given to the mechanical properties, surface quality, high-strength, wear resistance and electrical and thermal conductivity, scratch and chemical resistance, isolation and density. Almost the half of the companies asked has tried to modify their compounds with several additives while the

same percentage claims that they are aware of some potential applications of nanotechnology in plastics. However, only the only 4% answered that they are very familiar nanocomposites used in plastics, 40% that they are just familiar and 40% that are not familiar at all. Most Spanish companies admitted that they source of information is technical/ specialized literature review, 10% through participation in survey/studies while the Spanish and German companies asked 25% through contact with other companies, organizations or professionals. In Greece and Cyprus there is a huge lack of information in the field. Moreover, companies admitted that is rather difficult to find any suitable information or training possibilities on the use of nanocomposites (35%) while they express interest in producing thermoplastic composites reinforced with nanostructured carbon for structural or other type of applications. Finally, almost the fifty percent of the companies asked towards in house training specialization believe it is useful, 22% very useful, 13% fairly useful and 3% not useful at all. Almost the same percentages are met when referring to online training and the self- training procedure after the implementation of the didactic period. Having a tutor or experienced teaching staff in this topic is also important at the same lever for them useful while they believe that a well-designed e-learning which will provide a wide platform of information and networking with other EU countries for the exchange of good practices and information would be of a great benefit for any organization.