



# Mass Customization and SMEs

*– challenges & opportunities for Italian & Austrian companies –*

Presenters: Elena Fassa, Cipriano Forza, Gerhard Leitner, Immanuel Safrin, ..... & the crew

- Various communications regarding the MC 4.0 project
- Introduction of the topics addressed in the event

*(please see the other file)*




# Tailor-made products, mass customization, digital transformation:

*how SMEs face the challenge*



# Mass Customization: *what is it?*

# Mass Customization: a way to face the customization challenge

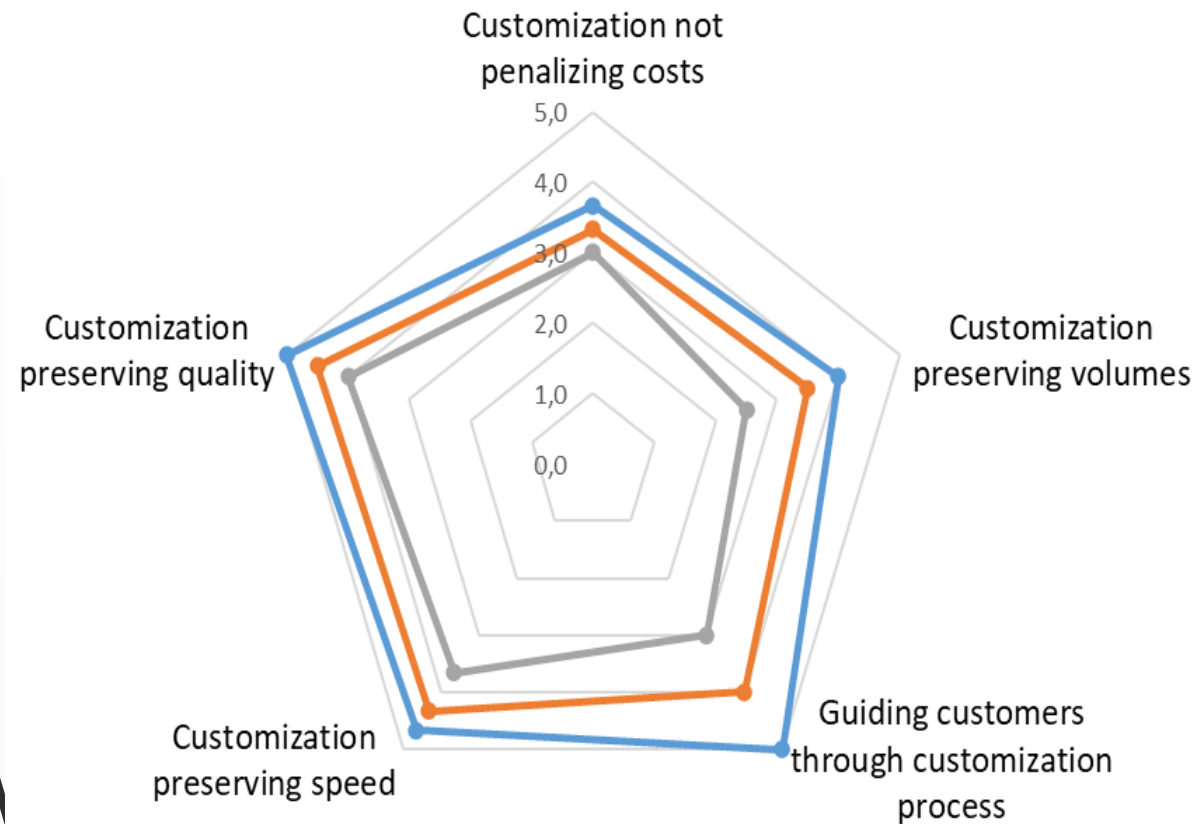
- 
- Offering more product variety or deeper product customization
    - allows to better satisfy the specific needs of single customers
    - makes more difficult to reach cost, time and even quality targets
  - Mass Customization **goal** is that of
    - developing, producing, marketing and delivering **affordable** goods and services
    - with enough **variety and customization** that nearly **everyone** finds **exactly what s/he wants**
  - Mass Customization requires three essential capabilities:
    - **understanding the customers'** idiosyncratic needs
    - having operations able to process customized orders as **efficiently as the standard** ones, and
    - supporting each customer in identifying his/her own solution while **minimizing** his/her **choice complexity**



# Mass Customization:

*What is its level in Italian SMEs?*

# MC adoption: overcoming the trade off between variety/customization and operative performance



To what extent do you agree or disagree with the following statements, on the scale of 1 to 5 below?

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE

➤ Trade-offs well or reasonably well addressed by SMEs

- variety-customization versus quality
- variety-customization versus speed

➤ Trade-offs still not addressed by SMEs

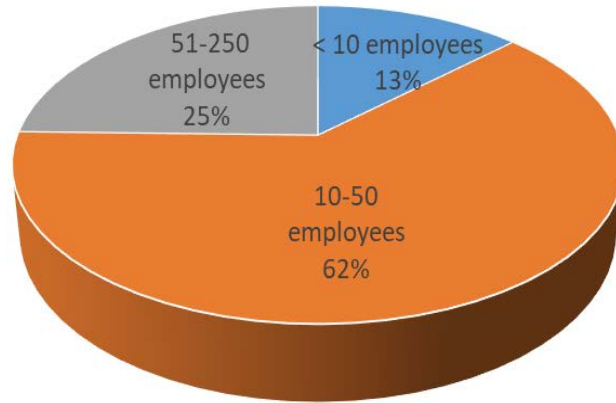
- variety-customization versus volume
- variety-customization versus cost

➤ Trade-offs with huge differences across SMEs

MC 4.0 project obtained this figures involving 103 Italian SMEs mainly manufacturers

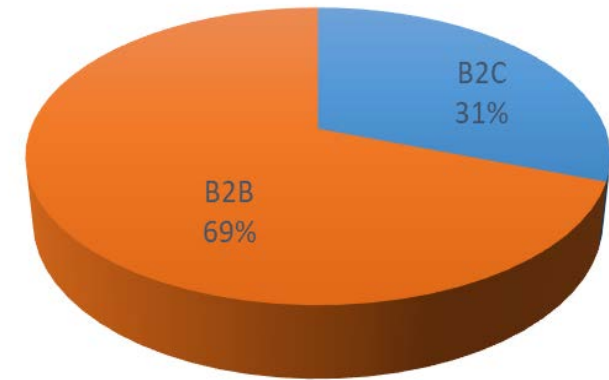
# Characterization of the considered sample of Italian SMEs

Company size (Number of

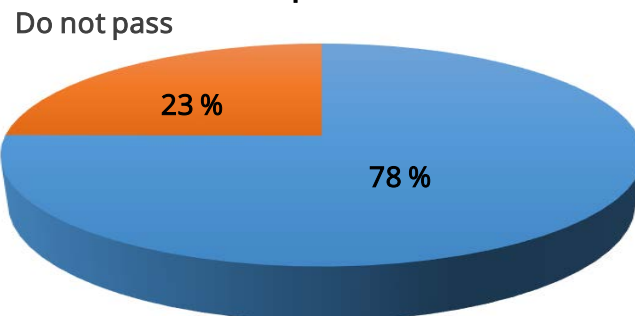


- Prevalence of
  - small companies
  - business to business
  - direct channels
- High presence of mixed customization strategies
- Difficulties to describe product space
- Many orders pass through the R&D department

Kind of

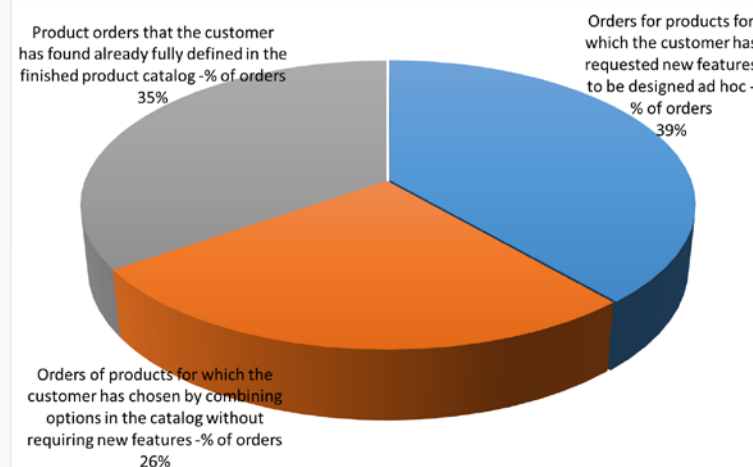


Path of orders through R&D department

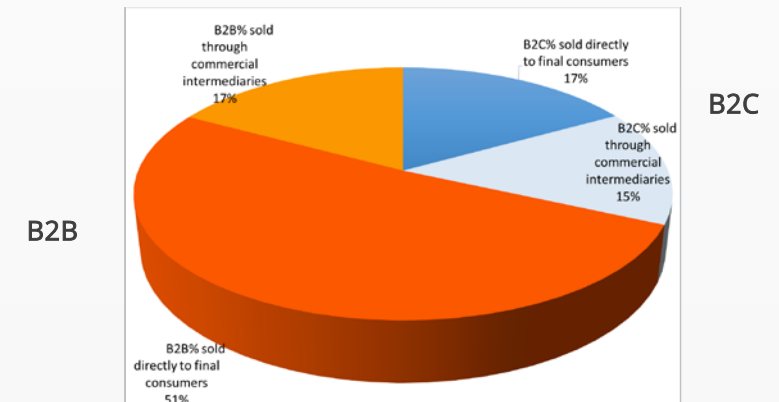


Average percentage of orders that pass through the technical or R&D department

Degree of customization



Kind of customers & distribution channels





# Mass Customization:

*What is its level in Austrian SMEs?*



## Sample

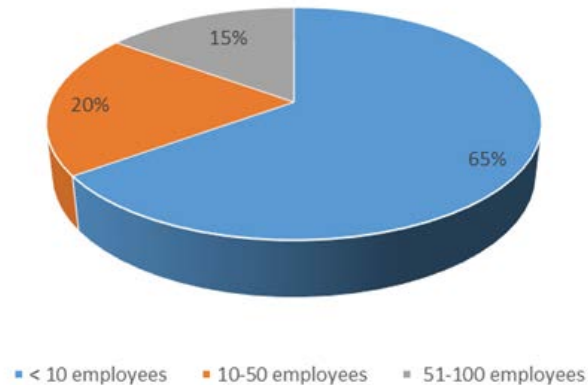
- 20 SMEs interviewed
- The sample is quite heterogeneous in terms of dimensions (No. of employees, Annual Turnover)
- Diverse subsectors of "Smart Living"
  - Architecture, construction, complete buildings
  - Enhancement of buildings in diverse aspects (energy consulting, isolation, doors/windows, specialization in materials(wood, bricks, concrete) or specific building infrastructure (lighting, shading, heating, cooling)
  - Furniture / components for interior design
  - Surveillance, alarms, electric installations and smart home solutions

# Characterization of the considered sample of Austrian SMEs

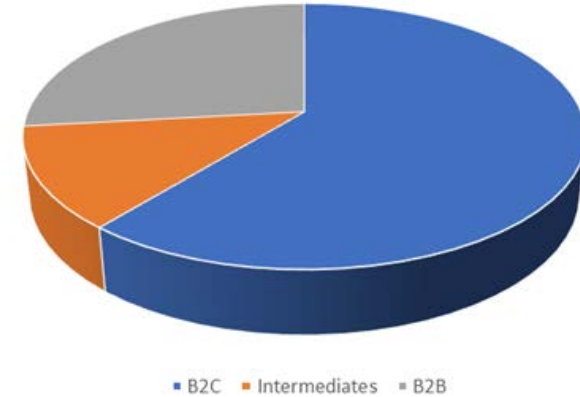
## Prevalence of

- small companies
- Business to Customer ( $\frac{2}{3}$  to  $\frac{1}{3}$  B2B)
- typically direct channels
- ▶ Mixture of Standardized / Customized and R&D build Products
  - Some companies have 100% custom products

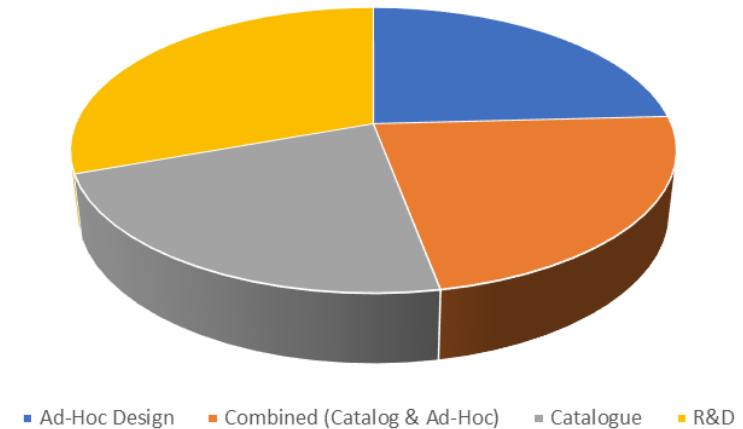
Number of Employees



Customer Structure



Product/Solution Origin





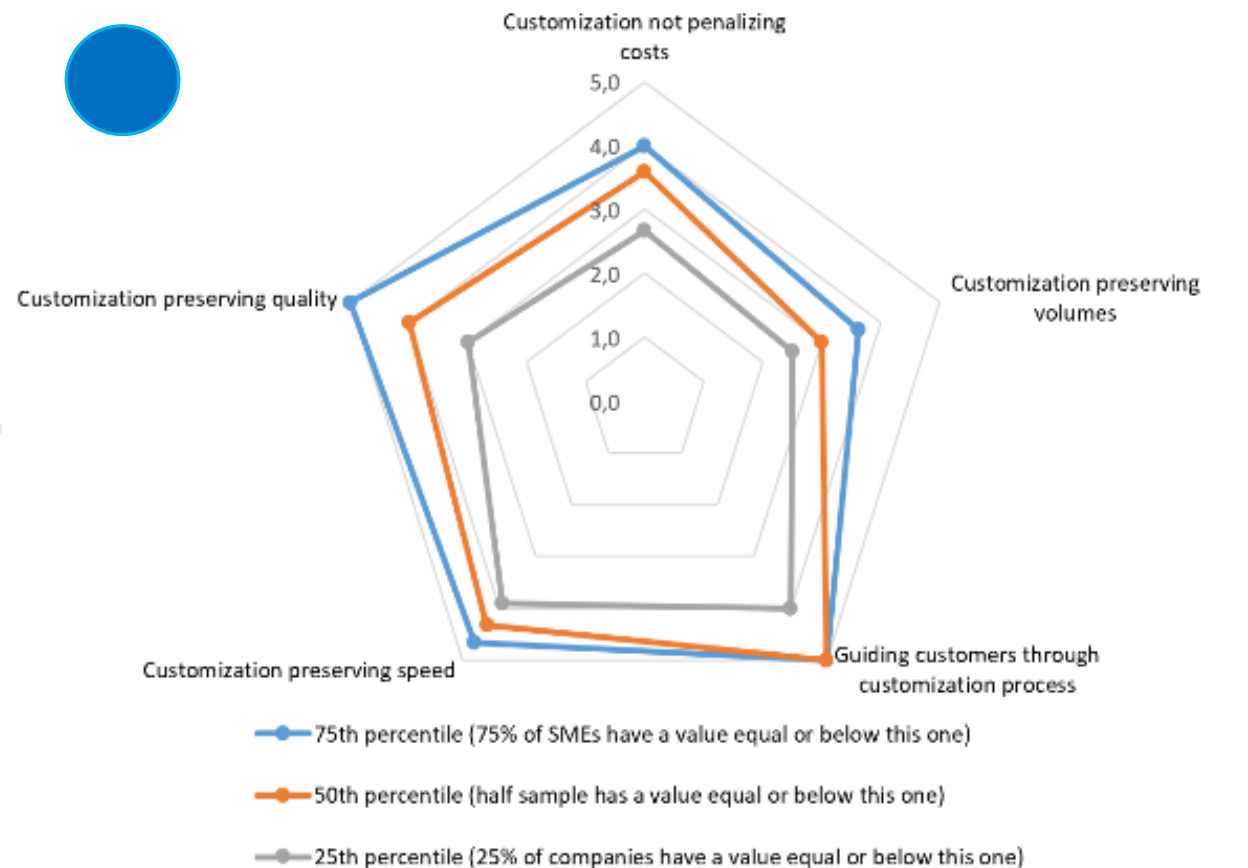
## The Austrian SMEs can be considered advanced in regard to Mass Customization (>4)

- Deal appropriately with client preferences
- Adequately guide the client through a personalization process
- Appropriately respond to personalization requests
- Identify those product attributes most important for personalization

Scale: From 1 – strongly disagree To 5 – strongly agree

Source: AT 1 Questionnaire Survey, MC 4.0

# MC adoption: overcoming the trade off between variety/customization & operative performance



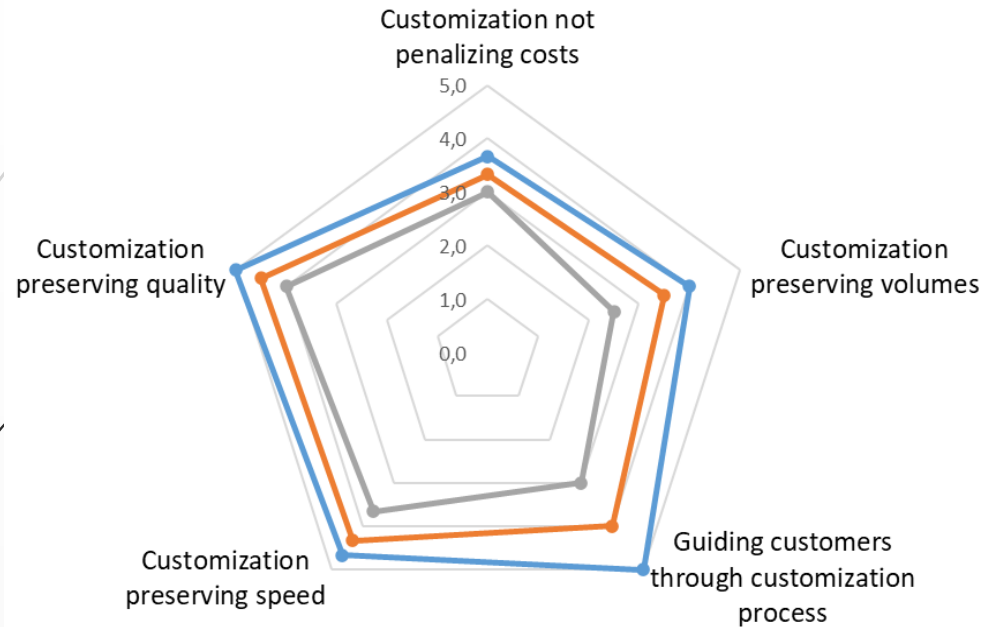
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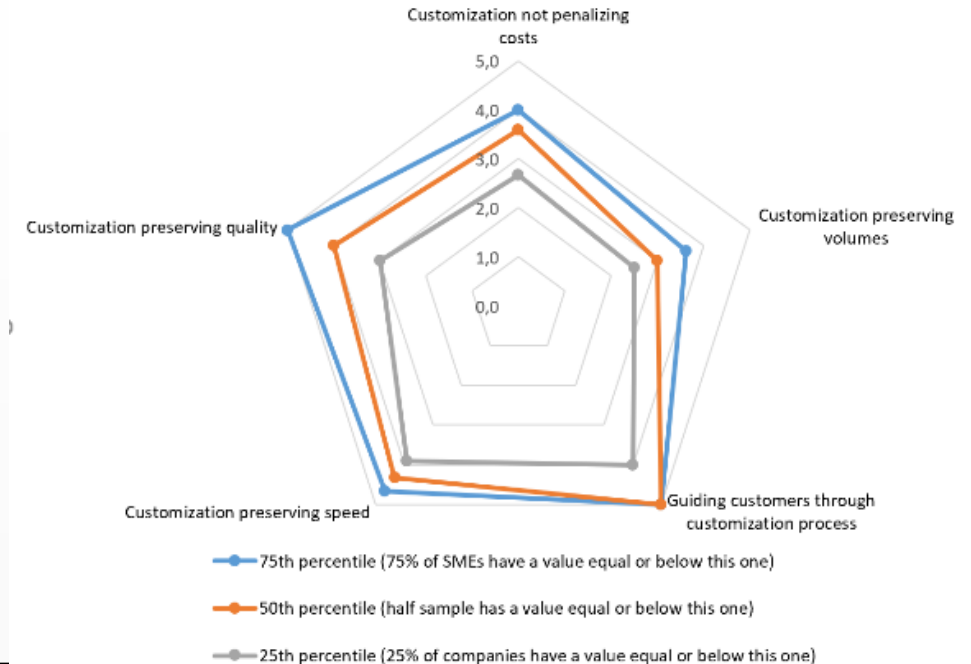
- Trade-offs well or reasonably well addressed by SMEs
  - variety-customization versus speed
  - variety-customization versus customers' guidance through the customization process
- Trade-offs not optimally addressed by SMEs
  - variety-customization versus volume
  - variety-customization versus cost
- Trade-offs with large differences across SMEs
  - variety-customization versus quality

# MC adoption: overcoming the trade off between variety/customization and operative performance

## SAMPLED ITALIAN SMES



## SAMPLED AUSTRIAN SMES



### ➤ Similar situation (IT vs AU)

- speed (+)
- cost & volumes (-)

### ➤ Different situation (IT vs AU)

- quality (+ IT) (+- AU)
- customer guidance (+- IT) (+AU)



# Levers for Mass Customization

*What are they? What are their effects?*

# Mass Customization levers

→ L1 - Part Standardization

→ L2 -

→ L3 -

→ L4 -

→ L5 -

→ L6 -

→ L7 -

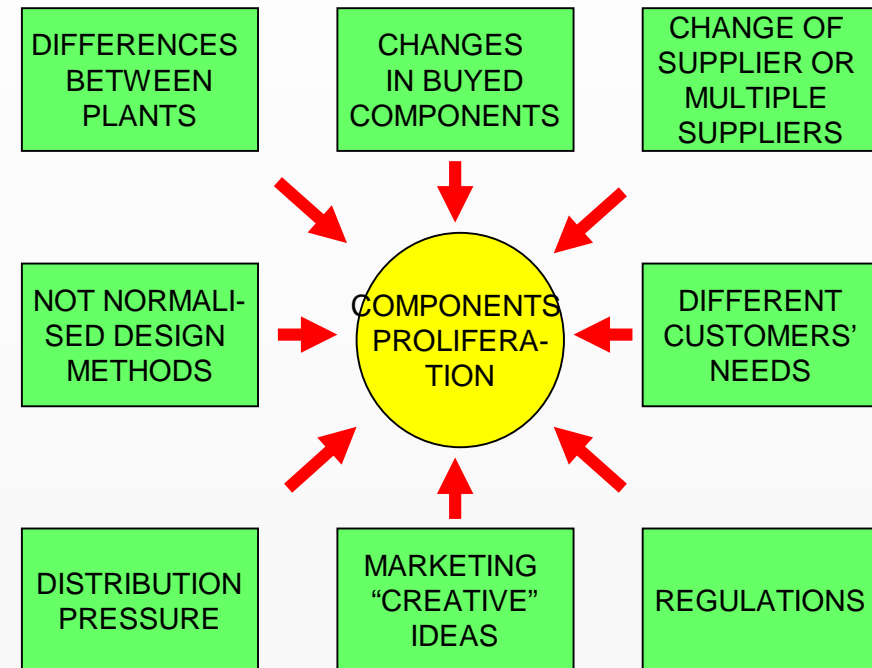
→ L8 -

→ L9 -

→ Standardization of parts, components, and processes

→ Within a product

→ Across different products



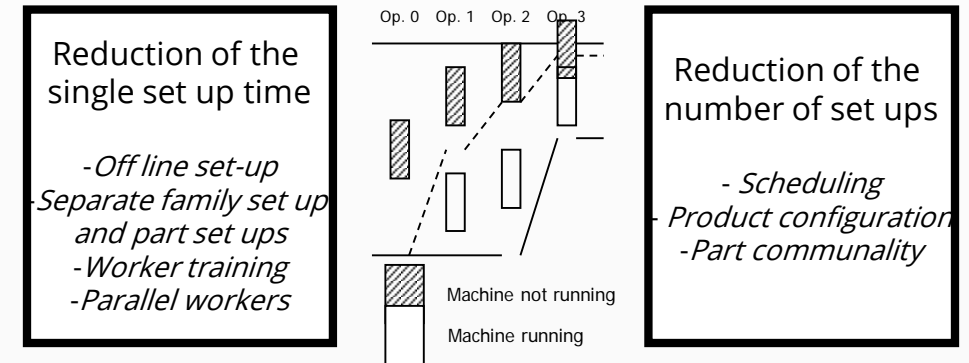
→ Increase economies of scale and scope



# Mass Customization levers

- L1 - Part Standardization
- L2 - Changeover improvements
- L3 -
- L4 -
- L5 -
- L6 -
- L7 -
- L8 -
- L9 -

- Changeover time reduction, instead of through batch size increase, may be obtained by:
  - Improving scheduling
  - Reducing the single set up time through either technological improvements or organizational improvement

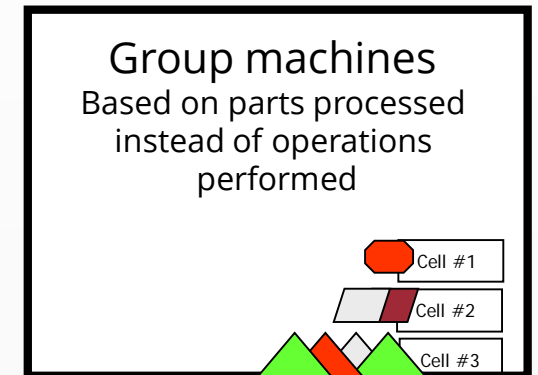
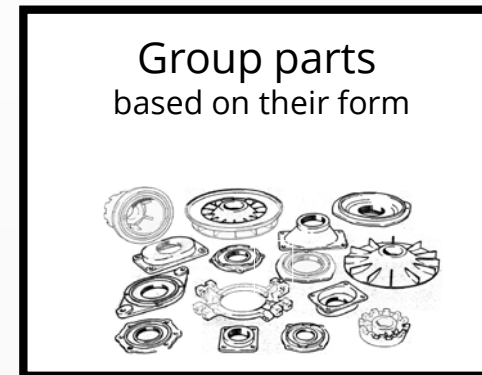


- Allows efficient production of small batches
- Changes the operating rules of the production system

# Mass Customization levers

- L1 - Part Standardization
- L2 - Changeover improvements
- L3 - Group technology
- L4 -
- L5 -
- L6 -
- L7 -
- L8 -
- L9 -

- General philosophy, which advocates the systematic recognition and exploitation of similarities
- May be applied both
  - in production (cells)
  - in design

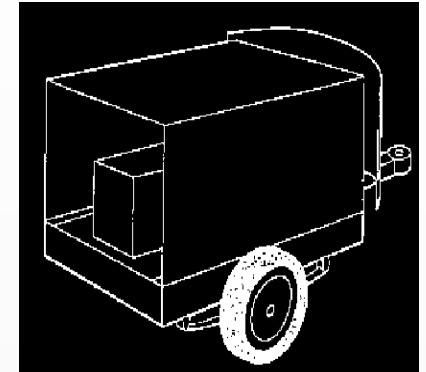
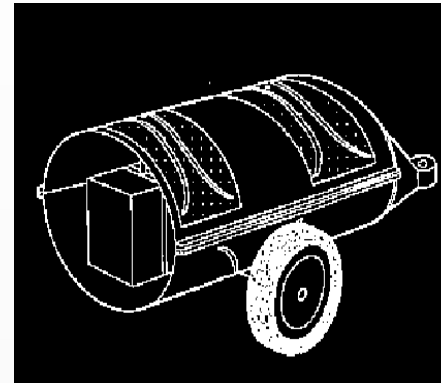


- Reduction in the number of different things that have to be processed in each working position

# Mass Customization levers

- L1 - Part Standardization
- L2 - Changeover improvements
- L3 - Group technology
- L4 - Product modularity
- L5 -
- L6 -
- L7 -
- L8 -
- L9 -

- Each function is implemented by a distinct, dedicated component
- Interfaces are standardised



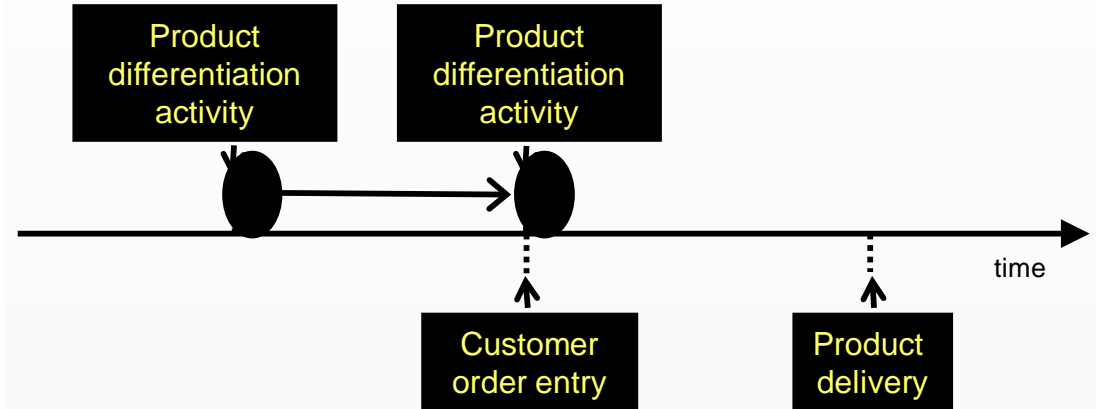
- It is possible to make changes to any given component of the product without having to modify the interacting ones
- Greater efficiency in design, sourcing and production

# Mass Customization levers

- L1 - Part Standardization
- L2 - Changeover improvements
- L3 - Group technology
- L4 - Product modularity
- L5 - Form postponement
- L6 -
- L7 -
- L8 -
- L9 -

- Changes in form and identity occur at the latest possible point in the marketing flow. Product differentiation activities may be moved:

- From to-stock to to-order
- Closer to order receipt (remaining to stock)
- Closer to order delivery (remaining to order)



- Better balance between responsiveness and working capital
- Effects may be different across different types of form postponement

# Mass Customization levers

→ L1 - Part Standardization

→ L2 - Changeover improvements

→ L3 - Group technology

→ L4 - Product modularity

→ L5 - Form postponement

→ L6 - Virtual build to order

→ L7 -

→ L8 -

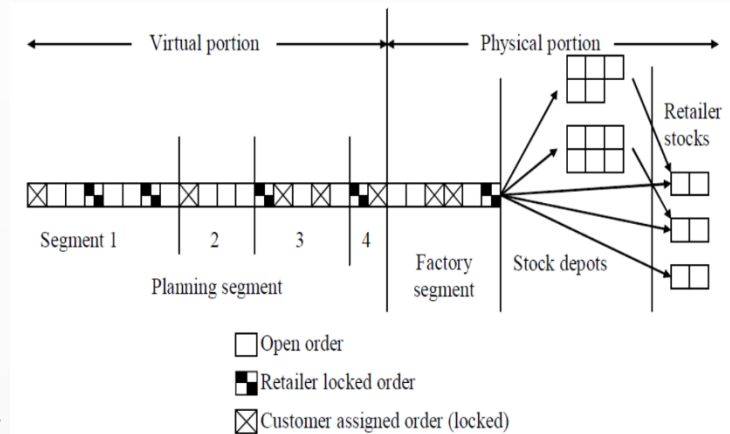
→ L9 -

→ Virtual-build-to-order (VBTO) is a form of order fulfilment system in which the producer has the ability to search across the entire pipeline of finished stock, products in production and those in the production plan, in order to find the best product for a customer

→ A customer order can be fulfilled by a product:

- taken from finished stock
- taken from the pipeline that matches the required specification
- taken from the pipeline that is reconfigured in some way to match the specification
- that is entered at the start of the customer order pipeline i.e. a Built-to-Order (BTO) product

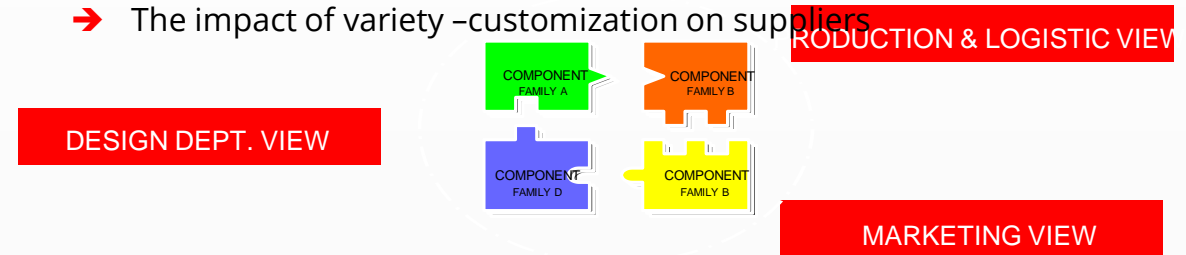
Customer order pipeline



# Mass Customization levers

- L1 - Part Standardization
- L2 - Changeover improvements
- L3 - Group technology
- L4 - Product modularity
- L5 - Form postponement
- L6 - Virtual build to order
- L7 - 3D concurrent engineering
- L8 -
- L9 -

- Since its beginning, the design process considers:
  - Form postponement to improve material management
  - Parts and component standardization
  - Process robustness (ability to work with different inputs while maintaining efficiency)
  - The impact of variety –customization on suppliers

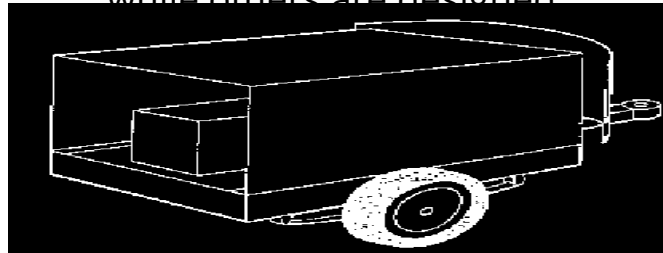


- Marketing, supply chain, internal operations and product technology are more coherent
- Less frictions between functions
- Efficient customization

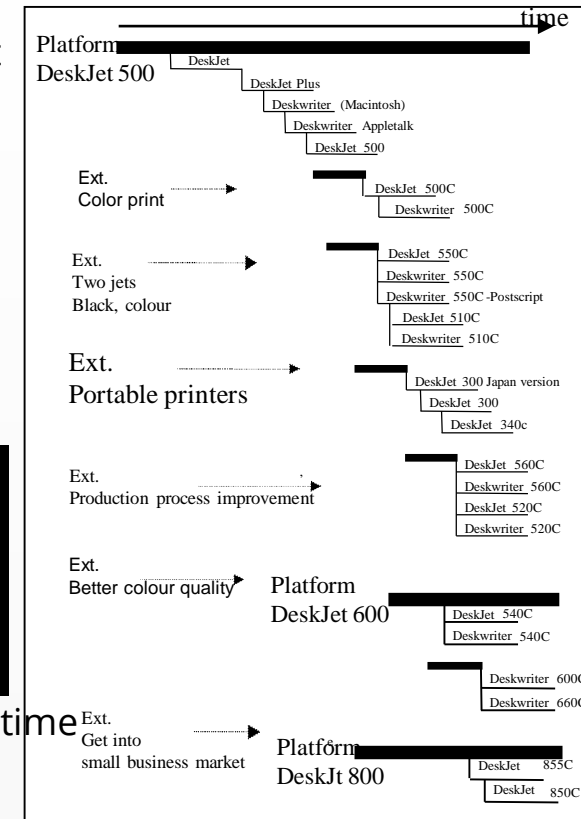
# Mass Customization levers

- L1 - Part Standardization
- L2 - Changeover improvements
- L3 - Group technology
- L4 - Product modularity
- L5 - Form postponement
- L6 - Virtual build to order
- L7 - 3D concurrent engineering
- L8 - Platform based product development
- L9 -

- Simultaneous development of an entire family of products that
  - address a related set of customer needs
  - have the potential to share components, interfaces between components, and production processes
- Some models are fully designed while designing the platform while others are designed



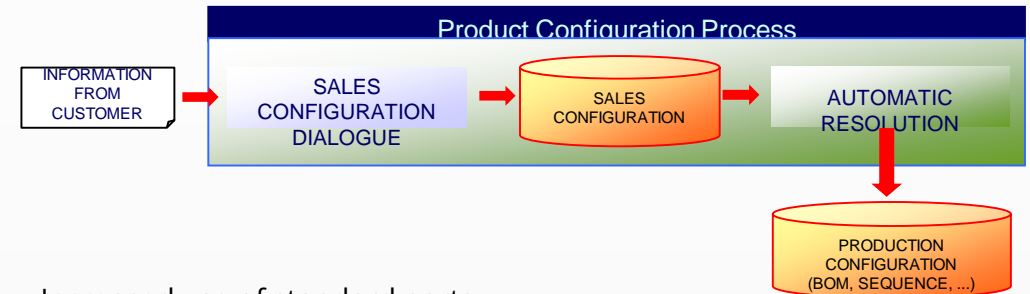
- Use of investments for a longer time
- Favour learning curve



# Mass Customization levers

- L1 - Part Standardization
- L2 - Changeover improvements
- L3 - Group technology
- L4 - Product modularity
- L5 - Form postponement
- L6 - Virtual build to order
- L7 - 3D concurrent engineering
- L8 - Platform based product development
- L9 - IT supported product configuration

- Predefinition of which product functionalities to accept and which to refuse
- Redefinition of the modality for obtaining each functionality
- IT to support the presentation of product functionalities and to support the check of congruency between choices
- IT support to automatically produce Bill Of Material and production sequences



- Increased use of standard parts
- Reduced deep personalization
- Reduced workload for each order
- Reduced customer decisional effort and increased customer trust





# The adoption of MC levers *in Italian SMEs*

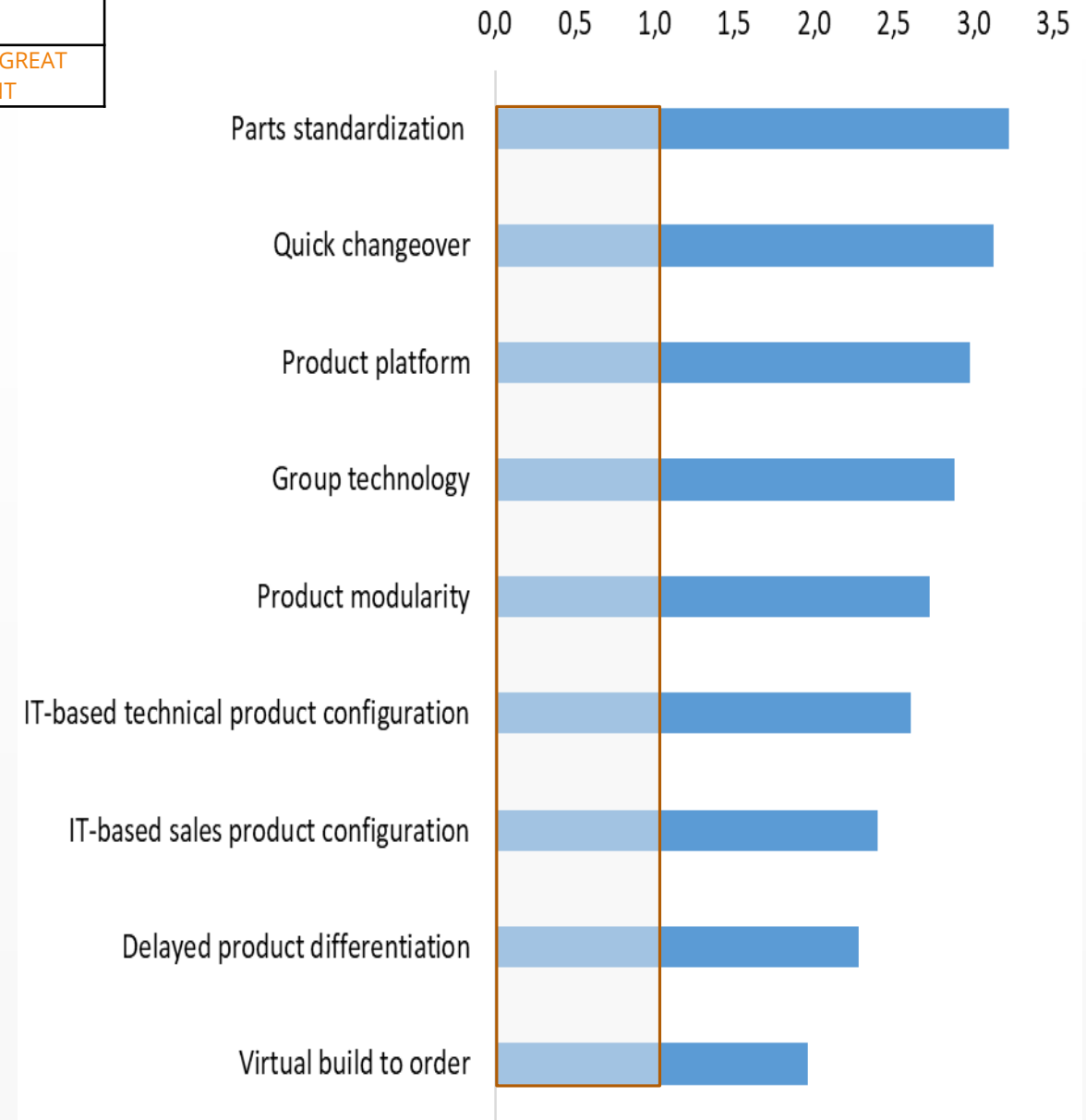


# Average level of use of MC levers

How common is the use of each of the following practices in your company?

1	2	3	4	5
NOT AT ALL	TO A SMALL EXTENT	TO A MODERATE EXTENT	TO A GREAT EXTENT	TO A VERY GREAT EXTENT

- The use of MC levers is not high
  - However, the fundamental MC levers (quick changeover & parts standardization) are on average quite used
- Some more advanced levers are used at less extent:
  - to increase commonality (e.g. product platform & group technology) and
  - to align the customer side with the technical and production side (e.g. product modularity & sales configurators)





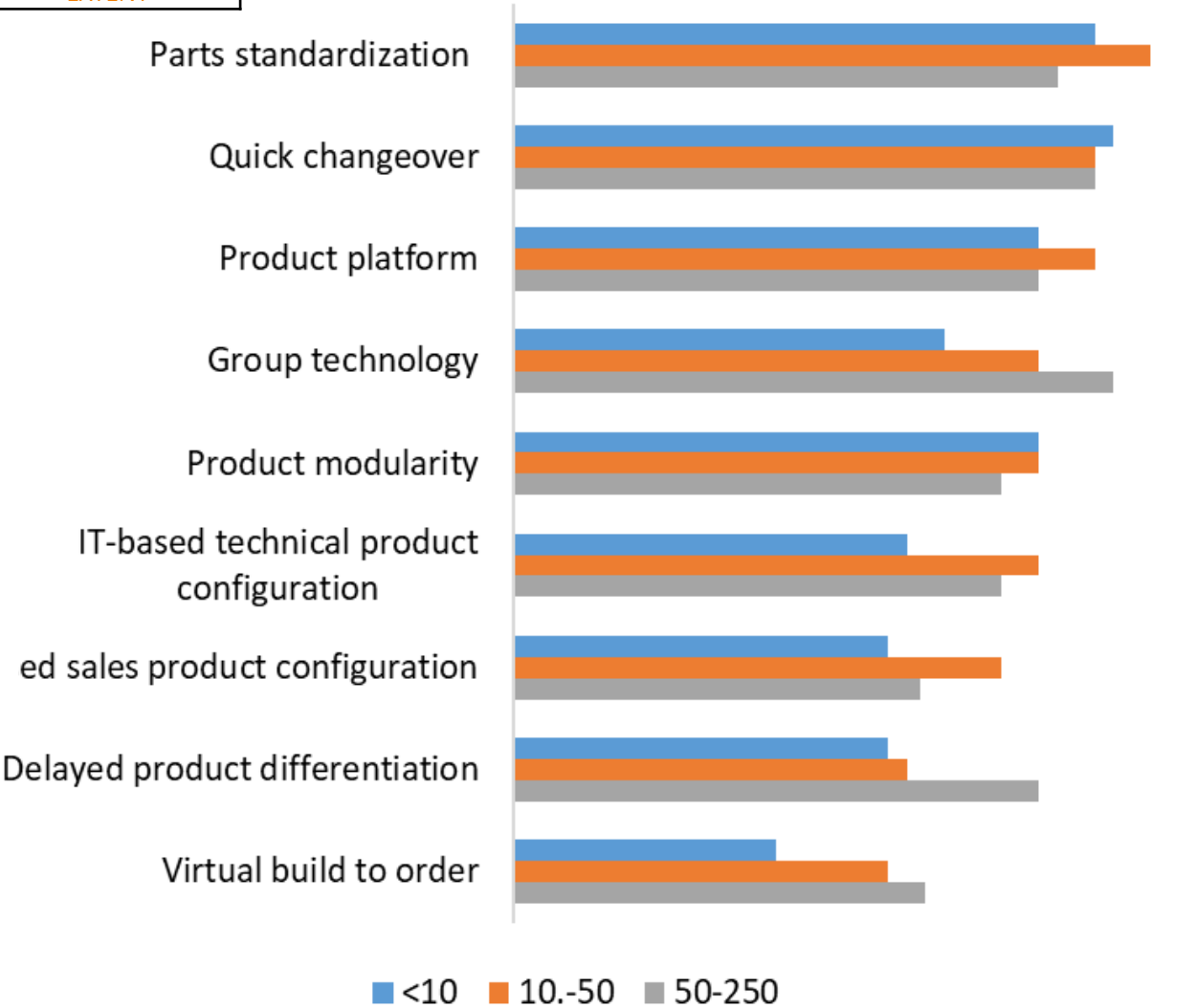
# MC levers use across different companies size

How common are the following practices in your company?

1	2	3	4	5
NOT AT ALL	TO A SMALL EXTENT	TO A MODERATE EXTENT	TO A GREAT EXTENT	TO A VERY GREAT EXTENT



- The most used MC levers are almost equally used across different SMEs size
- The lowest used MC levers is lower in the smallest SMEs



# The adoption of MC levers *in Austrian SMEs*

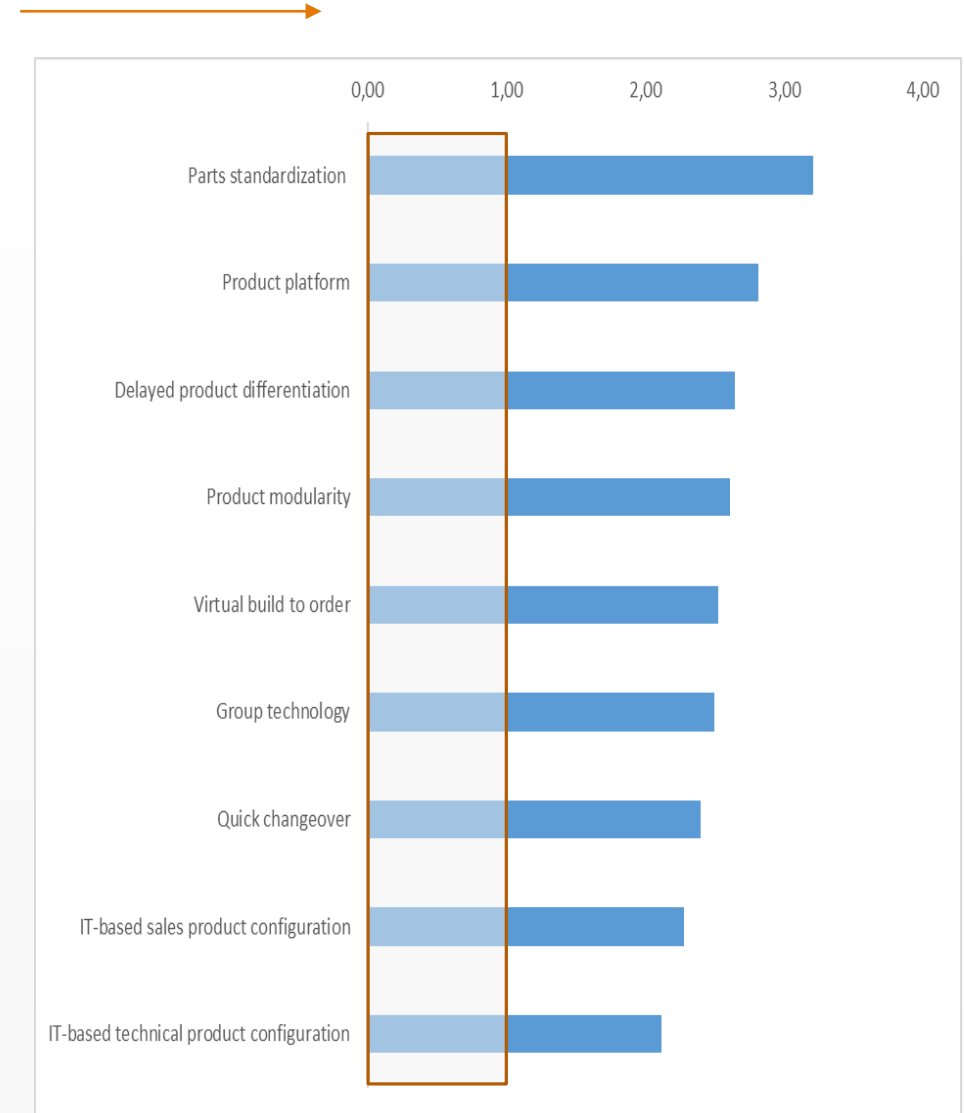
# Average level of use of MC levers in the Austrian Sample

How common is the use of each of the following practices in your company?

1	2	3	4	5
NOT AT ALL	TO A SMALL EXTENT	TO A MODERATE EXTENT	TO A GREAT EXTENT	TO A VERY GREAT EXTENT

➡ The use of MC levers is – in general - not high

- The fundamental MC lever **Parts Standardization** of is on average quite used
- The next lever - **product platform** - is also used by the majority of companies, but in this case the platform is typically provided by the manufacturer or wholesale, the SME are cooperating with
- Other advanced approaches that mainly serve to increase commonality, such as **delayed product differentiation**, **product modularity**, **virtual build to order** and **group technology**, are applied to a lower extent by the surveyed companies
- The lowest degree of application is observed in the levers that are related to configuration technology (**sales configuration** and **product configuration**)



# Consequences for MC 4.0 subsequent activities in AU

## The Domotic System For You

Smart Homes bieten vielfältige Möglichkeiten für Konsument\*innen und ein breites Betätigungsfeld für Unternehmen, die in diesem Bereich tätig sind.

Digitalisierung ist der Schlüssel dazu, in allen Bereichen des privaten Wohnens.



### Außenbereich, z.B.:

Pool  
Gartengestaltung  
Wege und Einfahrten  
Be- und Entwässerung  
Umzäunung / Einfriedung  
...



### Gebäude, z.B.:

Materialien  
Bauweisen  
Dach  
Türen / Fenster  
Energieeffizienz  
Isolierung  
Energiegewinnung  
Elektrik  
Installation  
...



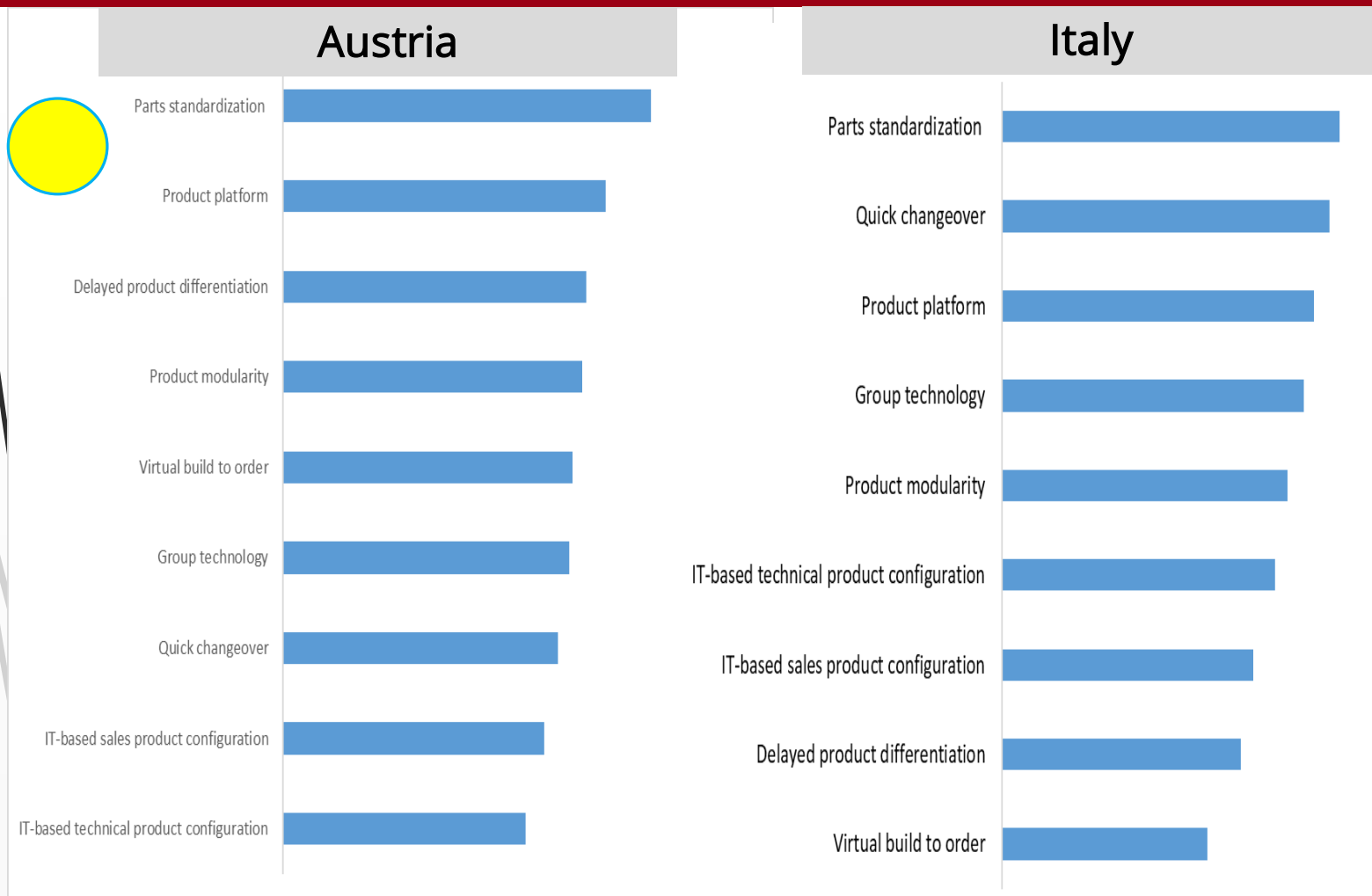
### Innenbereich, z.B.:

Beleuchtung  
Entertainment  
Beschattung  
Heizung  
Komfort  
Sicherheit  
Gesundheit / Wohlbefinden  
...



- Given the heterogeneity of considered Austrian SMEs and the consequent different situation in MC levers adoption (specifically IT based configuration) we choose:
  - finding a common denominator to show the potentials of configuration
  - *i.e. test domotics*

# Level of use of MC levers – Italian vs Austrian SMEs



➤ Differences seems to be due to the fact that there are

- more manufacturers in the Italian sample
- more installers in the Austrian sample

➤ In both samples


- some levers seems to generally applicable
- other levers seems to be more used in certain contexts



# Configurable products, configuration activities & configurators



# Configurable products

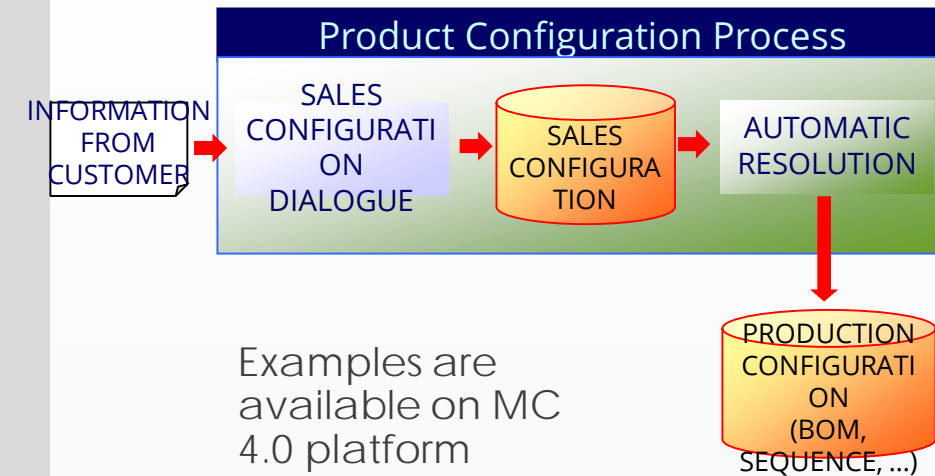
- 
- Usually we say that a product family is configurable when its products have a **common & stable structure** but **not all their details are specified** because:
    - there are many options/variants to choose among so that the specific product variant has to be defined/created together with the customer
    - it is possible to define new functionalities (or new values for existing functionalities) that don't need the product structure to be changed
  - If all options to choose among are **pre-defined** it is **fully** (otherwise **partially**) **configurable** from **commercial** point of view
  - If for each possible commercial option the company has **pre-defined** the corresponding subsections of the bills of materials (and other technical documentation) than the product family is **fully** (otherwise **partially**) **configurable** from **technical** point of view

# The digitalization of the configuration process of configurable products

- What is **predefined** can be automatized/digitalized
- All the pieces of **predefined** information/documents and related combinations rules are modeled in a SW application called CONFIGURATOR

- Generate a **commercial configuration feasible and complete** to make a competitive and profitable offer
- **Generate technical documentation** needed to produce the commercial configuration
- ..... & eventually something else

- Select **product characteristics**
- Specify product characteristics that are not predefined
- Generate **image** (rendering, photo, sketch, etc.)
- Generate/determine **price**
- Generate/determine **cost**
- Generate product **code**
- Identify **components** that need **ad-hoc** engineering
- Generate **BOM**
- Generate **production cycle**
- Generate usage **instructions**
- Generate technical **drawings**
- .....




- **Greater efficiency** in
  - technical office
  - production
  - sales
- **Faster response** to
  - request of offer
  - order fulfillment
- **Less errors** in offers, BOM, codes, production cycles etc.
- **Capitalization of implicit knowledge**
- **Reduction of barriers for market expansion**



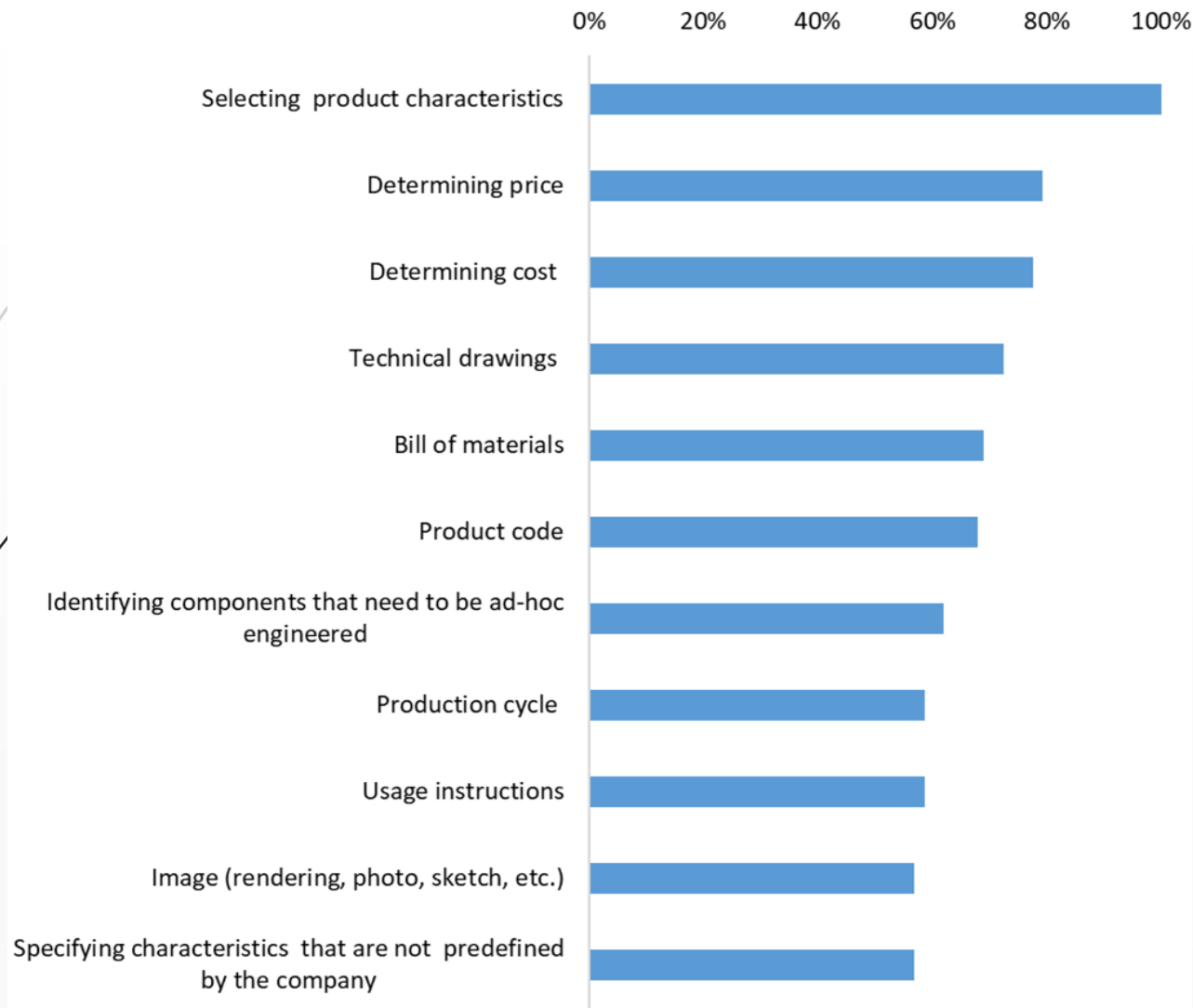
# Presence & digitalization of configuration activities in Italian SMEs

# Digitalization of customization activities assume many different for

- 
- ▶ Manufacturing SMEs do offer **product variety and customization**
    - ▶ They in part do it by offering configurable (or partially configurable) products
  - ▶ But, what is the extent of the **presence, in SMEs,**
    - ▶ of the various **product configuration activities &**
    - ▶ the **intensity of their digitalization?**
  - ▶ This knowledge is **useful** to identify specific **requirements for design and implementation of configurators**



# Presence of configuration activities



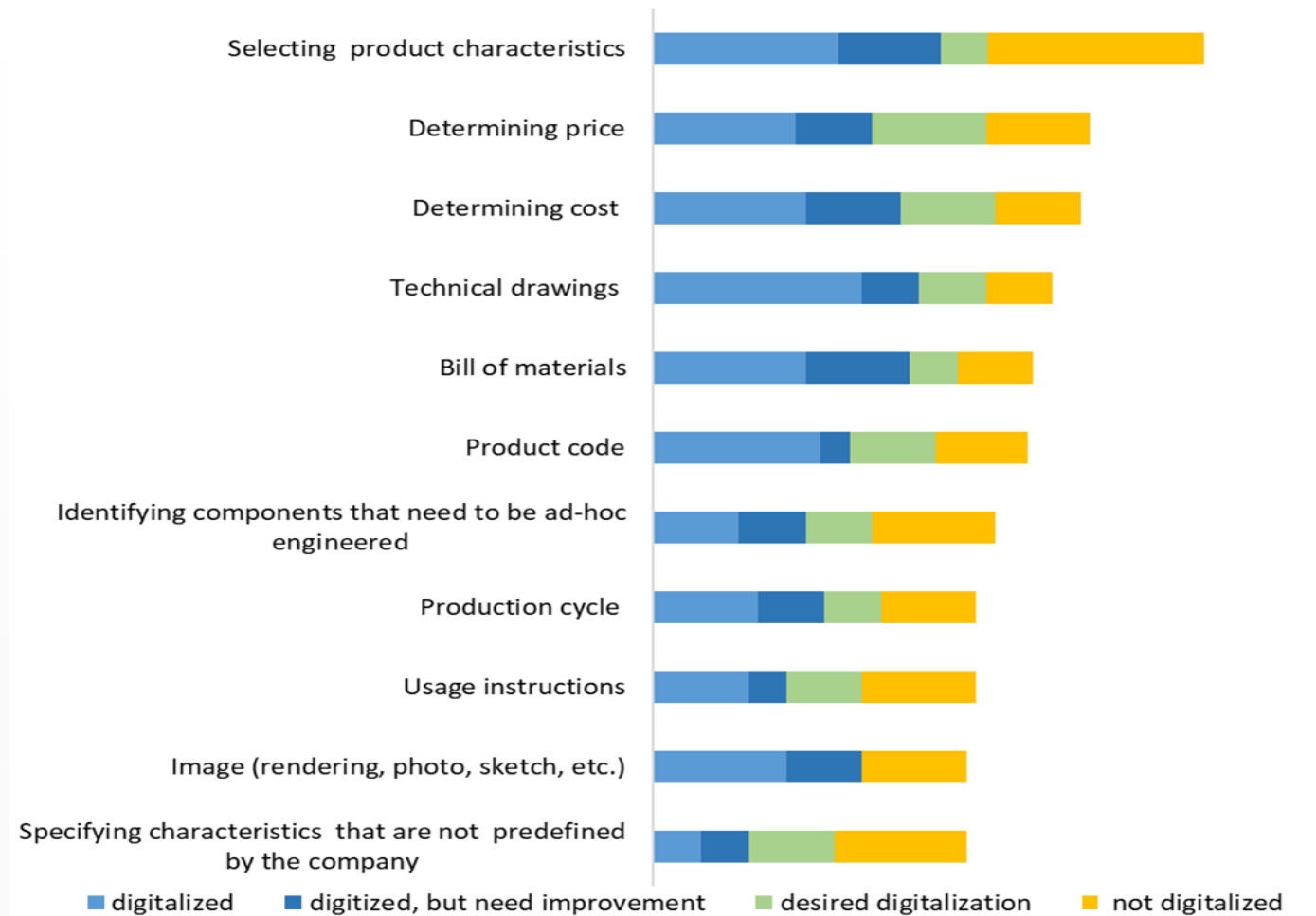
- More specifically it is carried out:
- 73 %: only by salespeople
  - 5 %: only by clients alone
  - 22 %: both by salespeople and clients alone

➤ All configuration activities are highly diffused across SMEs



# Digitalization of configuration activities

On average we can expect a digitalized activity will receive an upgrade in 35% of companies



- We can expect that on average each activity digitalization will be upgraded in half of its instances
- Upgrades are more diffusely searched for managing non predefined functionalities and new components

# Digitalization of configuration activities -> Implications

## ➤ Overall digitalization:

- Significantly digitalized (in particular Web, ERP and MRP)
- Digitalization is size dependent

## ➤ Digitalization of configuration activities:

- Relatively high
- High variability across activities
- Significant need for digitalizing non-digitalized activities
- Significant need to improve digitalization of digitalized activities

## ➤ Need for configurators

➤ able to manage partial configurability

➤ less expensive and

➤ that facilitate the breakdown of a configurator project in smaller self-paying projects

➤ Need for tailored implementation processes

➤ Need to understand the role of “non-professional” configurators



# Presence and digitalization of configuration activities in Austrian SMEs





## Utilized Instruments / Digitalization solutions

- 73% use online presence (web and social media) For inquiry, order, product presentation, contact information
- ~ 10% use Excel or unspecified tools (either to support sales and/or production configuration, such as CAD, Stock management, Accounting)
- 7% use ERP (Enterprise Resource Planning ->e.g. SAP)
- Not at all used are MRP, PDM, PLM (material requirements planning, product data management, product cycle planning), or payment and customer/collaboration features
- Configuration is done in some cases, but not with specialized tools, what is completely missing are integrated solutions.




# Issues and opportunities raised by entrepreneurs and managers

# Global Trends in Mass Customization and Digital Transformation (Industry 4.0)


- The coalignment of MC 4.0 levers is needed to successfully implement mass customization
- Configuration technology is crucial for future implementation of mass customization
- SMEs do not have a clear view of Industry 4.0 implementation and Digital transformation
- SMEs could suffer a risk of a digital gap, in some sectors more than in others since disruptive technologies differ in their impact across sectors
- The disruption of international supply chains due to COVID and the need for more flexible supply chains is favoring the development of local competencies and re-shoring to Europe
- SMEs must consider sustainability in their strategies for the future
- In the living sector, domotics is a very complex issue with high uncertainties and with considerable sustainability and customization implications
- Domotics projects require high assessment efforts before starting because subsequent changes are hard to implement and costly
- The presence of **customization in manufacturing** small and medium enterprises (SMEs) is widely known

# Customization Management: Trends, Opportunities and Threats for Veneto's SMEs

- 
- ▶ Variety and customization of the products and services offered by Veneto SMEs are constantly increasing
  - ▶ This trend increases organizational complexity and costs and can become a threat if appropriate solutions are not implemented
  - ▶ Customization is also an opportunity: for example, many Veneto SMEs were born and are born to satisfy specific customer personalization needs not satisfied by the market
  - ▶ Technological innovation is also an important opportunity to be exploited both to offer innovative products and services and to improve business processes (for example by implementing Industry 4.0 solutions)
  - ▶ Customization and technological innovation lead to the need for organizational change and adaptation
  - ▶ In this context, human resources play a fundamental and critical role, for example in terms of individual competencies (both soft skills and technical-professional skills), resistance or not to change, acceptance of technology
  - ▶ With reference to training for Industry 4.0, the topics most important and immediately applicable are cyber security, data analysis and digital integration of processes

# Mass Customization in Sustainable Buildings: Design the Performance of the New Construction Industry

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- 
- ▶ In the building sector, the Mass Customization approach clashes with the customer's desire to have a unique product
  - ▶ In the construction sector, standardization is more effective and replicable if applied to the process rather than the product
  - ▶ The current trend is to customize the envelope rather than the plant
  - ▶ Small and medium-sized companies often find difficult to share their know-how. Universities and Standards could play an important role in providing guidelines
  - ▶ There is often a gap between the desire to outline a Mass Customization strategy and the ability to manage its developments and apply it in practice
  - ▶ Having a holistic approach, the designer has a fundamental role in the Mass Customization process
  - ▶ For many small and medium-sized companies it is not economically viable to develop Mass Customization projects from scratch
  - ▶ Mass Customization in the building sector should start with the industrialization of the construction site

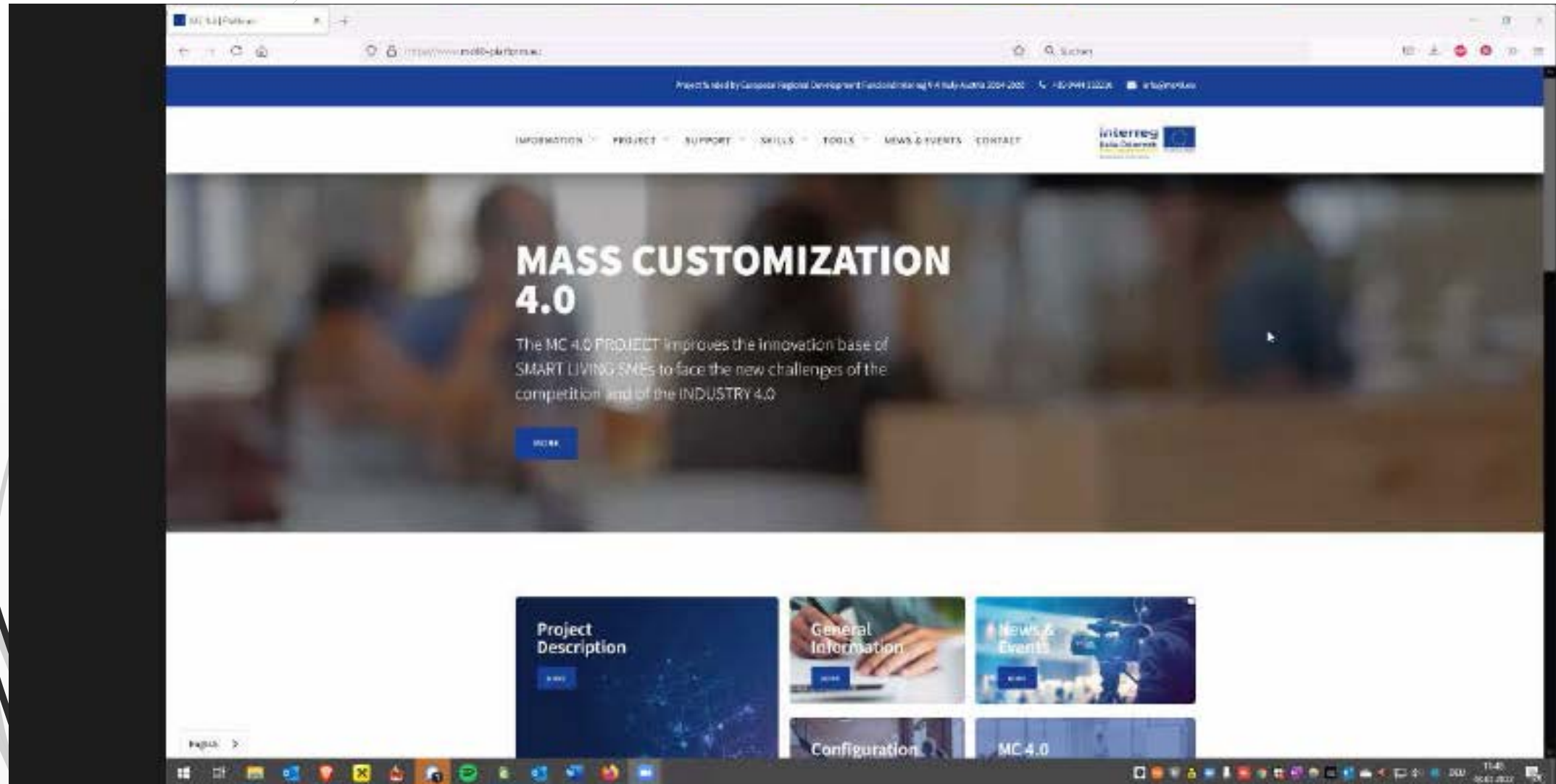
# Launch of the MC 4.0 Platform

*offering tools and services to SMEs  
for the development of 4.0 business  
systems and interaction between  
producers and customers*

# By Energhieforum Kärnten

- Live presentation of the MC 4.0 Platform

*(please go to <https://www.mc40-platform.eu/mass-customization>)*



# Interreg

V-A Italia-Austria 2014-2020

Mass Customization 4.0

European Regional Development Fund



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# Thank you for listening