Value chain mapping methodology

The value chain mapping methodology was developed through the BRIDGES project. It was tested in the five (5) BRIDGES regions and, thanks to inter-project synergies, it is being tested further through the BERRY+ S3 partnership.

Background

OBJECTIVE

To describe a value chain mapping methodology leading to the identification of competitive advantage and interregional complementarities, leading to better policy decisions.

BACKGROUND

The value chain mapping was initially made in the context of the BRIDGES project 5th call, additional activities. It is selected and contributes to the implementation of the BERRY+ S3 partnership (

https://s3platform.jrc.ec.europa.eu/berry).

The value chain approach was selected for the following reasons: value-chains (i) can support long term interregional collaboration: the Phase 1 and Phase 2 of the BRIDGES project confirmed, on the one hand, the importance of interregional complementarities and, on the other hand, the luck of systematic approach towards them. Value chains can be an instrument, a carrier for interregional complementarities; (ii) can contribute to competitive advantage and through that to regional specialisation and diversification; (iii) can contribute to internationalisation of regional economies through the integration of businesses and innovation system actors integrate into collaborative efforts; (iv) are priorities of the EU's new industrial strategy as factors supporting European autonomy[1], confirmed also by the Council's conclusions 16.11.2020[2] and further reinforced by the New Industrial Strategy update COM(2021)350final.

According to the approved BRIDGES project AF, the objective is to reinforce regional resilience by in-shoring and re-shoring value-chain based productive activities, while, at the same time, also identifying those activities that is best to be done in collaboration with other regions (near

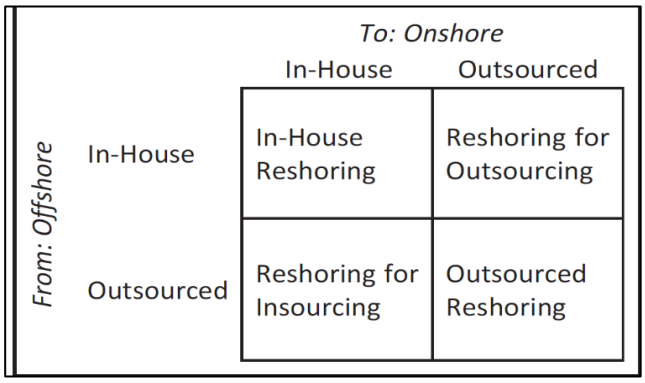
[1] "Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe's recovery ", 05 May 2021. https://ec.europa.eu/info/sites/default/files/communication-industrial-strategy-update-2020_en.pdf .

[2] Council conclusions on "A recovery advancing the transition towards a more dynamic, resilient and competitive European industry" adopted by written procedure on 16 November 2020. https://data.consilium.europa.eu/doc/document/ST-13004-2020-INIT/en/pdf.

shoring). On the other hand, the whole BERRY+ effort is reaching and benefitting from interregional complementarities based on the value-chain approach.

The focus of the whole effort is on in-shoring and re-shoring competitive advantage in relation to specific value chains and, in parallel, to identify and invest in near-shoring value chain segments in which a region is not specialised or in which it is not interested. The terminology of reshoring is fundamentally territorial[3]. It is a question of where manufacturing is located, rather than by whom it is performed (that is, whether the manufacturing is insourced or outsourced). Much of the literature on reshoring also tends to present the concept as a reversal of offshoring (Gray et al., 2013[4]). Near-shoring refers to manufacturing being relocated to a country closer to 'home'.

Figure 1 Models of re-shoring[5]



The following value chains were selected to be mapped: forest industry side-streams (Kainuu, FI), recyclable and renewable textiles (Helsinki-Uusimaa, FI), dairy industry side-streams (Western Macedonia, GR and Western Slovenia, SI), and e-health equipment (Western Transdanubia).

The value chain mapping was done by applying a methodology devised by the BRIDGES project Phase 1, namely through the action plan of the LP/PP2, and the feasibility study for the renewal of the berry industry of Kainuu (Action 2)[6]. The feasibility study included a supply chain mapping of the berry industry as a whole, with detailed reference to technologies, end products, inputs, markets and policies, Table 1.

[3] European Parliament Research Service (EPRS) (2021). Post Covid-19 value chains: options for reshoring production back to Europe in a globalised economy. Policy Department for External Relations Directorate General for External Policies of the Union PE 653.626 – March 2021. https://www.europarl.europa.eu/RegData/etudes/STUD/2021/653626/EXPO_STU(2021)653626_EN.pdf

[4] Gray, J. V. et al. (2013) 'The Reshoring Phenomenon: What Supply Chain Academics Ought to know and Should Do', Journal of Supply Chain Management, 49(2), pp. 27–33. doi: 10.1111/jscm.12012.

[5] Gray, J. V. et al. (2013) 'The Reshoring Phenomenon: What Supply Chain Academics Ought to know and Should Do', Journal of Supply Chain Management, 49(2), pp. 27–33. doi: 10.1111/jscm.12012:p28.

[6] Kainuu action plan; https://projects2014-2020.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1565773671.pdf

Table 1 The berry industry supply chain grid[7]

	Key technologies		Products	Application	Key investment	Promotion	Policy, 3S, industrial modernisation/ agrifood	Partnership/ Markets
Input /raw material	Cultivation development in field an forest (wilderness)	Facilitative: ICT and logistics	Cultivars, lines, material from specified production	Correct raw material to correct process	Plant breeding	Economic sustainability	Rural (innovation) policy	Horticulture, agriculture, forestry,
Harvesting	Harvesting technology	Primary supply networks	Harvester: robot or hand-held tools	Intensification of the harvesting process	Automatic, robotics	Sustainability, naturalness	(Rural) innovation policy	Robotic, censor technology markets
Storing	Storage manufacturing	Logistics	Optimization	Balancing of the input to processing	Renewable energy, material efficiency	Clean technology	Energy and climate policy	Energy technology
Cleaning	Sorting, cleaning, grading – utilization of side flows	Robotics, blockchain technologies	Fresh products	Food and food ingredients	Automatization	Naturalness, organic, freshness, cleanness, health impacts, sustainability	Nature-based innovation, clean investment, competition, health, SDG	Manufacturing
Processing	Extraction – utilization of side flows, deoil	Assembling critical masses, stabilizing (drying and freezing)	Berry juice concentrates, berry nfc juices and syrups. Purees with seeds.	Food, feed, end ingredients	Extraction facilities-concentration –(hot water, ethanol, supercritical l-CO2 circulation	Naturalnes, organic, freshness, cleanness, health impacts, sustainability, techn. quality	Nature-based innovation, clean investment, competition, health, SDG metrics	Food technology
	Dewater, dry, deoil, grinding		Berry powders for feed, food Grinded material for cosmetics compensate plastic beans	Food, feed, cosmetic ingredients	Mill/grinder, separator, drier, cocentrator SFE	Naturalness, organic, cleanness, health impacts, sustainability, techn. quality	Innovation (purity), clean investment, competition, transparency, health, SDG metrics	Food technology, cosmetics technology
	Functional food and cosmetic ingredient processing	Critical quality of the raw material, wide spectrum	Aromatic ingredients, functional polyphenolics, seed oil, fibre, stains	Cosmetics	Extraction facilities-concentration –(hot water, ethanol, supercritical l-CO2 circulation	Naturalness, organic, cleanness, health impacts, sustainability, techn. quality	Innovation (purity), clean investment, nature-based competition, transparency, health, SDG metrics	Cosmetics technology
	Consumer product processing	Encapsulation (micro, nano) fron the extract during the drying process	Consumer product for feed, for food, for cosmetic	Consumer products in combination with oat ingredients (together with Valio and Dermosil etc.)	Food technology investments	Taste, applicability, naturalness, organic, health impacts, cleanness, sustainability, image building	Health, food, Innovation (purity), clean investment, nature-based competition, transparency, SDG metrics	Food, feed, heath care, hotel services, sports, fashion and life style enterprises and NGOs

During Phase 3 (additional activities) of the project, the initial grid was further developed into a value chain mapping methodology with policy-making linkages. The development steps consisted of linking the supply chain grid to regional and interregional development & investment initiatives, by building on regions' mapped competitiveness (peaks) and addressing weaknesses (valleys). The intended value chain integration ensures market access for final and intermediate goods and it is a pull factor for orienting diversification and scaling up.

Regional competitiveness can be measured in various ways, including entrepreneurship, technological readiness, and quality of institutions[8]. Researchers confirm that measuring regional

[7] Kainuu action plan, page 10. Grid developed by LUKE professor Dr. Sirpa Kurppa. https://projects2014-2020.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1565773671.pdf

[8] Moirangthem, N.S. and Nag, B. (2022), "Measuring regional competitiveness on the basis of entrepreneurship, technological readiness and quality of institutions", *Competitiveness Review*, Vol. 32 No. 1, pp. 103-121. https://doi.org/10.1108/CR-11-2020-013.

competitiveness by GDP alone is not sufficient[9]. The definition of the criteria for mapping the value chains in the BRIDGES regions aimed at discussing regional strengths and weaknesses, as well as regional potential, i.e. strengths that can be revealed, realised in the future. We took into account baseline findings about value chains as expressed, e.g. by the IMF research paper on *Measuring competitiveness in a world of global value chains*[10], and the reference to Paul Armington who showed that "in a world in which goods produced by different countries were imperfect substitutes for each other" (page 6). We also took into account the discussion raised by Stöllinger et al 2018[11], indicating how industrial value chains turn into regional value chains and how they differ than global value chains.

We came up and tested a mix of criteria, quantitative and qualitative, and we relied on the Martin report, page 7-1[12]: "The competitiveness of a region resides not only in the competitiveness of its constituent individual firms and their interactions, but also in the wider assets and social, economic, institutional and public attributes of the region itself. Therefore, the notion of regional competitiveness is as much about qualitative factors and conditions (such as untraded networks of informal knowledge, trust, social capital, and the like) as it is about quantifiable attributes and processes (such as inter-firm trading, patenting rates, labour supply and so on). Furthermore, the causes of competitiveness are usually attributed to the effects of an aggregate of factors rather than the impact of any individual factor". Our proposed criteria include business, product, research (on going + programmes), research results, solutions available, education and skills, and policies, Table 2.

Table 2 Criteria for identifying regional value-chain related peaks and valleys

Criteria	Competitiveness measures	Data collection methods
Business	Turnover, exports, employment, location quotient	Statistical data and statistical analysis
Product	Product range, product added value, product innovation, exports	Statistical data and statistical analysis
Research	On-going research programmes dedicated to addressing the selected domain.	Field data (interviews) with research units in the region. We are seeking concentrations of research
Research	Patents, registered IPR, TRL achievement level	Review of patents; field data

[9] Barna, K. (2007). Measuring regional competitiveness. Journal of Central European Agriculture, CC BY-ND 4.0.

[10] Tamim Bayoumi ; Maximiliano Appendino ; Jelle Barkema ; Diego A. Cerdeiro (2018). Measuring Competitiveness in a World of Global Value Chains. IMF working papers, https://www.imf.org/en/Publications/WP/Issues/2018/11/01/Measuring-Competitiveness-in-a-World-of-Global-Value-Chain-45544 . Page 6.

[11] Roman Stöllinger (coordinator), Doris Hanzl-Weiss, Sandra Leitner, and Robert Stehrer (2018). Global and Regional Value Chains: How Important, How Different?. Vienna Institute for International Economic Studies. Research report 427. https://wiiw.ac.at/global-and-regional-value-chains-how-important-how-different-dlp-4522.pdf .

[12] Cambridge Econometrics and ECORYS NEI, Prof. Ronald L. Martin (.....). A Study on the Factors of Regional Competitiveness. A draft final report for The European Commission, Directorate-General Regional Policy. https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/3cr/competitiveness.pdf .

Criteria	Competitiveness measures	Data collection methods
results, solutions	in projects related to the selected industry.	(interviews) with research units in the region.
Skills available	University faculties and educational programmes including technical education dedicated to improving entrepreneurship, management and implementation skills in the selected industry.	Review of educational programmes in the region; field data (interviews) with educational units in the region.
Policy enablers	Strategies and project calls for (i) increasing research inputs to product development; (ii) bringing innovations to market; (iii) commercialising research; (iv) supporting national & interregional collaboration for technology transfer; (v) entrepreneurship programmes in diversified domains of traditional sectors; (vi) incentives for attracting investments related to in- shoring and / or re-shoring evidence-based potential.	Field data (interviews) with educational units in the region.

These criteria were mapped against the supply chain grid categories, Table 3. The value chain mapping approach is summarised in Table 3, and an excel template is also available to facilitate the application of this model and attached to the value chain mapping directory.

Table 3 Summary of the value chain (VC) mapping approach.

Value chain mapping based on supply chain linkages

	Key technologies			Products	Application	Key in-vestment	Promotion	Policy, 3S, industrial modernisation/ agrifood	Partnership/ Markets
	Input /raw material	**Cultivation development in field an forest (wilderness)**	**Facilitative: ICT and logistics**	Cultivars, lines, material from specified production	Correct raw material to correct process	**Plant breeding**	Economic sustainability	Rural (innovation) policy	Horticulture, agriculture, forestry,
Business									
Product									
Research									
Solution									
Skills available (none, some, average, very good, seeking to transfer knowledge and curricula)									
Policy									
	Harvesting	Harvesting technology	**Primary supply networks**	**Harvester: robot or hand-held tools**	Intensification of the harvesting process	**Automatic, robotics**	Sustainability, naturalness	(Rural) innovation policy	Robotic, censor technology markets
Business									
Product									
Research									
Solution									
Skills available (none, some, average, very good, seeking to transfer knowledge and curricula)									
Policy									
	Storing	Storage manufacturing	**Logistics**	Optimization	Balancing of the input to processing	**Renewable energy, material efficiency**	Clean technology	Energy and climate policy	Energy technology
Business									
Product									
Research									
Solution									
Skills available (none, some, average, very good, seeking to transfer knowledge and curricula)									
Policy									
	Cleaning	**Sorting, cleaning, grading – utilization of side flows**	**Robotics, blockchain technologies**	Fresh products	Food and food ingredients	**Automatization**	Naturalness, organic, freshness, cleanness, health impacts, sustainability	Nature-based innovation, clean investment, competition, health, SDG	Manufacturing
Business									
Product									
Research									
Solution									
Skills available (none, some, average, very good, seeking to transfer knowledge and curricula)									
Policy									
	Processing	**Extraction – utilization of side flows, deoil**	Assembling critical masses, stabilizing (drying and freezing)	Berry juice concentrates, berry nfc juices and syrups. Purees with seeds	Food, feed, end ingredients	**Extraction facilities- concentration –(hot water, ethanol, supercritical I- CO2 circulation**	Naturalness, organic, freshness, cleanness, health impacts, sustainability, techn. quality	Nature-based innovation, clean investment, competition, health, SDG metrics	Food technology
Business									
Product									
Research									
Solution									
Skills available (none, some, average, very good, seeking to transfer knowledge and curricula)									
Policy									
		Dewater, dry, deoil, grinding	Logistics	Berry powders for feed, food, Grinded material for cosmetics compensate plastic beans	Food, feed, cosmetic ingredients	**Mill/grinder, separator, drier, cocentrator SFE**	Naturalness, organic, cleanness, health impacts, sustainability, techn. Quality	Innovation (purity), clean investment, competition, transparency, health, SDG metrics	Food technology, cosmetics technology
Business									
Product									
Research									
Solution									
Skills available (none, some, average, very good, seeking to transfer knowledge and curricula)									
Policy									
		Functional food and cosmetic ingredient processing	Critical quality of the raw material, wide spectrum	Aromatic ingredients, functional polyphenolics, seed oil, fibre, stains	Cosmetics	**Extraction facilities- concentration –(hot water, ethanol, supercritical I- CO2 circulation**	Naturalness, organic, cleanness, health impacts, sustainability, techn. quality	Innovation (purity), clean investment, nature-based competition, transparency, health, SDG metrics	Cosmetics technology
Business									
Product									
Research									
Solution									
Skills available (none, some, average, very good, seeking to transfer knowledge and curricula)									
Policy									
		Consumer product processing	Encapsulation (micro, nano) fron the extract during the drying process	Consumer product for feed, for food, for cosmetic	Consumer products in combination with oat ingredients (together with Valio and Dermosil etc.)	**Food technology investments**	Taste, applicability, naturalness, organic, health impacts, cleanness,	Health, food, Innovation (purity), clean investment, nature-based competition,	Food, feed, health care, hotel services, sports, fashion and life style enterprises and NGOs
Business									
Product									
Research									
Solution									
Skills available (none, some, average, very good, seeking to transfer knowledge and curricula)									
Policy									

Understanding of the regional potential revealed through the identified peaks and valleys, is reinforced by considering a region's actual and potential positioning along the value chain smiling curve, Figure 1.

Figure 2 The value chain smiling curve (2008)[13]

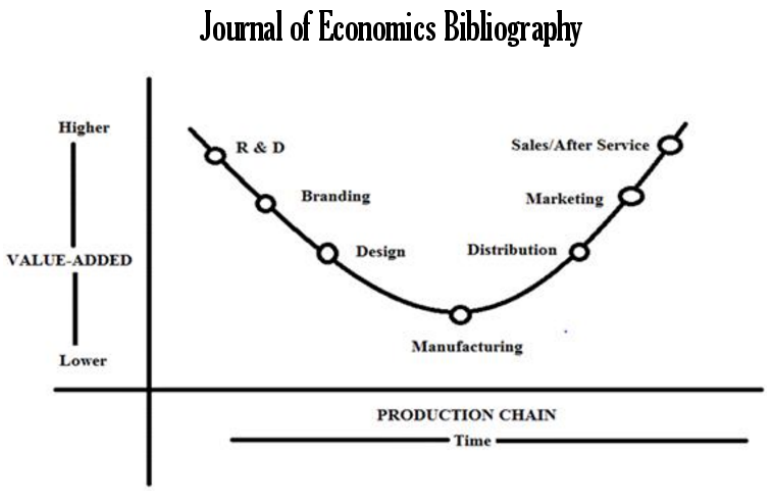
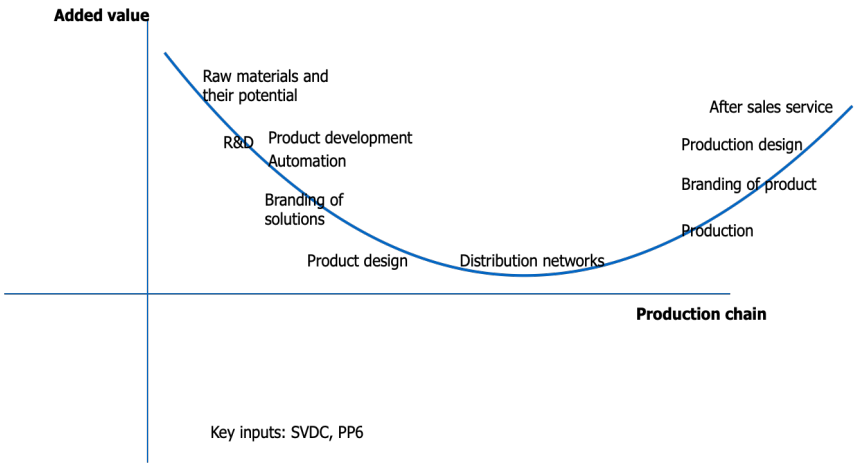


Figure 2. *The Smile Curve*
Source: Mudambi (2008)

Field inputs from the five regions[14] which tested the methodology during the BRIDGES project, indicate that the impact of covid19 and then the follow up critical changes, have been crucial for the regions in terms of the value-added activities of the smiling curve. Consequently, an adaptation of the initial concept was generated, Figure 2.

Figure 3 A re-interpretation of the smiling curve



[13] Aggarwal, S. (2017). Smile Curve and its linkages with Global Value Chains. Page 4; https://mpra.ub.uni-muenchen.de/79324/1/MPRA_paper_79324.pdf .

[14] Kainuu, FI; Helsinki-Uusimaa, FI; Western Macedonia, GR; Western Slovenia, SI; Western Transadanubia, HU.

The difference between the "old" and the newly generated smiling curve is in the positioning of activities (some have been added) along the value chain in terms of added value. We found, for example, that raw materials have high added value especially in terms of new types of products that are traditionally not anticipated; another addition is automation, and still another insight comes from the upgrading of manufacturing because of the evolution towards more and more knowledge intensive skills. Nevertheless, the logic of matching competitive advantage to added value across value chain segments as tool mapping regional contexts and identifying trans-regional complementarities, remains.

Development of the VC mapping tool

The value chain mapping tool was developed between 2019 – 2022, according to six (6) stages:

- STAGE 1 Selection of value chain and formulation of the supply chain matrix.(2019)
- STAGE 2 Defining criteria to operationalise the supply-chain matrix and map regional potential (peaks and valleys).(2021).
- STAGE 3 Test application of the VC mapping tool in five (5) EU regions. (2021-2022).
- STAGE 4 Validation of the tool (effectiveness assessment & applicability) and conceptualisation.
- STAGE 5 Diffusion of the tool beyond the BRIDGES regions and feedback analysis. (BERRY+ meeting, 2022).
- STAGE 6 Transferability: the method is operationalised into a transferable, 5-step tool (section below).

Applying the methodology

The mapping is organised according to 5 steps:

- STEP 1 Selection of value chain and definition of the supply chain grid.
- STEP 2 Selection of the criteria for linking the supply chain grid to regional competitiveness. Contracting agency and experts select among the criteria proposed in Table 2 for the value chain mapping. In general, it is expected that the larger a regional economy, the more the criteria will be focusing on quantitative assessments.
- STEP 3 Data collection through desk research & statistical analysis; data collection through face-to-face interviews with research and education institutions
- STEP 4 Analysis of the data. Identification of regional peaks and valleys and of the region's positioning in the concrete industry's value chain curve and the potential of the region to move in more competitive position. In-shoring, re-shoring, and near-shoring recommendations are made: the experts carrying out the value chain mappings, in collaboration with the contracting organisations
- STEP 5 Formulation of initiatives and implementation of the selected options among the recommendations made in Step4.

The relative advantage of this value chain mapping approach is that it can be tailored to all types of regions, for example its granularity allows to look into smaller regions as well and identify potential. It implies it is applicable to all types of regions from innovation leaders or leaders + to innovation modest regions,

Lessons learnt / critical aspects

1. The competences of the expert who made the supply chain grid: The person who is making the supply chain map is a high-level science & industry expert. Our experience is that anything less than that reduces the effectiveness and, most importantly, the potential understanding of the issues at hand.

2. The competences of the expert who made the data collection, the statistical analysis and the interviews: mapping the regional peaks and valleys, requires a statistician and a regional economic developer. We have researched how the identification of the peaks and the valleys can be linked to current regional statistics and to regional competitiveness, and also what are some unknown or underutilised strengths.

3. The on-going collaboration between contracting and the contracted (i.e. the experts) organisations and especially the active & positive involvement of regional policy makers. The value chain mapping findings have to be mainstreamed into development initiatives. They relate to in-shoring, re-shoring and near-shoring of value chains. Regional authorities and policy decision makers need to be involved to

4. The collaboration between and among regional authorities that are participating in the same value chain. It starts from the national level and proceeds to European level. The near-shoring will start through such initiatives that require deeper understanding and MoU confirmations.

5. Continue improving the methodology, and researching further how it can be systematised, and liaise with more complementarity mapping tools. We remind that our methodology has been conceived as a complementary approach to that introduced by GP7 (Balland & Boschma 2019[15]) which identifies interregional linkages based on the technologies present in patents. To identify interregional complementarities, requires that two regions interested in the same value chain, are making in parallel the value chain mapping or, that thanks to known performance of the region and / or the RIS3 planning studies, such complementarities are indicated.

[15] Pierre-Alexandre Balland and Ron Boschma (2019). SMART SPECIALISATION: BEYOND PATENTS. Project 2018CE160AT089/090 Final report.

Pierre-Alexandre Balland, Ron Boschma, Joan Crespo & David L. Rigby (2019) Smart specialization policy in the European Union: relatedness, knowledge complexity and regional diversification, Regional Studies, 53:9, 1252-1268, DOI: 10.1080/00343404.2018.1437900. To link to this article: https://doi.org/10.1080/00343404.2018.1437900.

Pierre-Alexandre Balland & Ron Boschma, 2019. "Mapping the potential of EU regions to contribute to Industry 4.0," Papers in Evolutionary Economic Geography (PEEG) 1925, Utrecht University, Department of Human Geography and Spatial Planning, Group Economic Geography, revised Sep 2019.

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