# Zhèng Hé's Indirect Impact on Europe: On Revolutionary Focal Groups of Production Revolutions

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**ABSTRACT**

*According to the model on production revolutions, elaborated by Leonid and Anton Grinin, the Covid-19 pandemic and the fourteenth century's Black Death have similar impacts on economic trajectories in terms of production principles. Andrea Komlosy added the spatial dimension to the model, which allows the identification of the 'focal groups' of revolutionists and their seedling nurseries of a new production principle in late fourteenth and early fifteenth century Europe. Ming Admiral Zhèng Hé's voyages across the Indian Ocean (1405–1433) had an indirect impact on the European economy: Trading on the re-established 'Maritime Silk Road' required silver for payment, whose eventual shortage caused a credit crunch in Europe, jeopardizing the phase transition to the mercantile-industrial production principle. Renaissance Humanists promoted a revolutionary epistemology in the fifteenth century. Christopher Columbus's discovery of America, a by-product of efforts to reconnect Europe to the Maritime Silk Road in response to the credit crunch was portrayed as a revolutionary achievement. The author's participation at a focal group of the Cybernetic Revolution before Covid-19 motivated his tracing the Renaissance Revolution.*

***Keywords:*** *Production Revolutions, Renaissance Revolution, World Systems, Hegemonic shift, China, Zhèng Hé, Georg Purbachius*.

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## INTRODUCTION

Andrea Komlosy (2022) amplified Leonid and Anton Grinin's foresight study (Grinin, Grinin, and Korotayev 2022) on the impact of Covid-19, based on the model of production principles, by adding the spatial dimension to merge it with the standard model of the 'Capitalist World System' (Wallerstein 1974). After the fourteenth-century Black Death and its immediate post-pandemic period, the armada of the famous Ming Admiral Zhèng Hé rebooted the Maritime Silk Road (Belich 2022: 232–233), which caused a credit crunch in disconnected Europe (Frankopan 2015:19). No vessel of Zhèng's armada ever reached Europe; however, crucial information did, furnishing a 'small world' (Watts, Strogatz 1998) of revolutionary-minded Renaissance humanists (Garner 1990) with the information that Africa can be circumnavigated. Doing so required deep sea navigation; pioneer humanists turned medieval scholarly astronomy into a kind of GPS required for. Since no one can see into the future, calibrating any model (as does Korotayev 2005) means running it backwards into history to check whether the model's rationale matches reasonably well-known data or evidence.

## THE THEORETICAL FRAMEWORK

Production principles (PPs) (Grinin 2012: 15–45; Grinin, Grinin 2020) are established by production revolutions. They are harbingers of new technologies, penetrating the entire society and deploying significant economic growth, which triggers rapid population growth and thereby substantial changes in the ways of life (Grinin, Grinin 2015). The established production revolutions are (a) the Neolithic Revolution to establish agriculture and craftsmanship as production principle, (b) the Industrial Revolution and (c) the Cybernetic Revolution:

The Neolithic Revolution: Childe (2002: 75) mentions the neolithic sciences to propel it, which can be reconstructed by now with the help of the farmers of 'Vavilov cultures', *i.e.* agricultural areas of original crop evolution and – diversity (Altieri, Hecht 1990; Brush 2004; Plachetka 2011, 2020a). The subsequent Urban Revolution was a phase transition (Zinkina *et al.* 2019: 16) under the aegis of an unfolding Production principle.

The Industrial Revolution, whose initial phase (Grinin 2012: 32) dates back to the last third of the fifteenth century, when Renaissance humanism sparked its scientific revolution, long before the advent of thermodynamic machinery such as the steam engine.

The prefatory phase of the ongoing Cybernetic Revolution started in the 1940s with the work of Alan Turing and others.

The original data of each Production Principle (PP) (Grinin 2012: 37–39) indicate its development phases (i–iv) and life span from its infancy to its 'fossilization' as PPs do not vanish at all. The increase of energy available for technical work (Plachetka 2020a: 158–166) associated with production revolutions is added to Grinin's data in Table 1.

*Table 1*

**Life cycle of each production principles and the span of time their specific revolutionaries need to achieve the hegemonic position (time unit: 1000 years)**

| | i | ii | iii | iv | v | vi | Time | % to HP | E p.c. in GJ |
|---|---|---|---|---|---|---|---|---|---|
| AGC | 2.7 | 2.3 | 1.5 | 1.3 | 1 | 0.6 | 9.4 | 69.15 | 40–70 |
| IND | 0.17 | 0.13 | 0.1 | 0.06 | 0.04 | 0.025 | 0.525 | 76.19 | 150–400 |
| CYB | 0.04 | 0.04 | 0.03 | 0.02 | 0.015 | 0.01 | 0.16 | 71.87 | ? |

*Legend to Table 1:* Left column: AGC= Agriculture-Craft, IND= Industry, CYB= Cybernetics, Time unit 10^3 years, First line: (i) transitional= New production principle in its infancy, (ii) 'adolescence' = expansion and growth, (iii) 'florescence' = phase of establishment, (iv) 'maturity' = Impact on other means of production, Hegemonic Position, (v) 'high maturity' = The growth of the individual production principle reaches its limits, (vi) 'preparatory' = Occurrence of phenomena which are not intrinsic parts of the Production Principle, HP = Hegemonic Position. Energy p.c. = Demand of energy per capita in GJ: 1 Gigajoule = 10^6 KJ = 1,000,000 Kilojoules.

*Source:* Grinin (2012: 39), on energy demand: Haberl *et al.* (2011: 2).

Table 1 shows that each specific (PP) requires a significant percentage of its life span to obtain its hegemonic position (HP) in a society. As acknowledged, the industrial PP penetrated society step by step. Each step is in fact a cluster of innovation sparking long-lasting trade waves (Kondratieff waves, K-waves). The Cybernetic Revolution whose cluster of innovation consists of medicine, additive technologies, nano- and biotechnologies, robotics, information sciences and 'cognitive technologies' – hence the acronym MANBRIC – is not just a 'booster rocket' to launch a new K-wave, but a full-fledged production revolution due a profound change of the role of human beings under the new PP's aegis (Grinin, Grinin, Korotayev 2022). Therefore, the data for the interplay between production revolutions and K-waves are given in Table 2.

*Table 2*

**Kondratieff waves (K-waves) and production principles (PP) in years CE**

| K-Wave | Period | Booster Rocket | Momentum | PP Phase |
|---|---|---|---|---|
| I | 1780–1840 | Textile | Manufactures | Industry iii |
| II | 1840–1890 | Railroads | Heavy Industry and Transport | Industry iv |
| III | 1890–1940 | Electricity, Chemicals | Mechanical Engineering | Industry v–vi |
| IV | 1940–1985 | Automobiles, electronics, plastics | Services | Industry vi |
| V | 1980–2020 | Personal Computer | Knowledge-based services | Cybernetics i–ii |
| VI | 2020–2060 | MANBRIC | Human Medicine *etc*. | Cybernetics ii–iii |

*Source:* Grinin and Grinin (2015).

We will now identify 'Nested K-waves' below (Table 3) which are supported by emerging PPs identifiable by a PP's life cycle (Grinin 2012: 39) with 1780 as baseline (see Table 2). K-waves have their upswing and downswing phases (Table 3, row 5). The known time spans determine the launch date of the nested K-wave and the year of supported phase transitions (Table 3).

*Table 3*

**The industrial Production Principle (PP) and nested K-waves (K) in years CE as integers**

| | Phases | i | ii | iii | iv | v | vi |
|---|---|---|---|---|---|---|---|
| 1 | PP Industry | 1430–1600 | 1600–1730 | 1730–1830 | 1830–1890 | 1890–1929 | 1929–1955 |
| 2 | Time span | 170 | 130 | 100 | 60 | 39 | 26 |
| 3 | S (total yrs) | 170 | 300 | 400 | 460 | 500 | 526 |
| 4 | K-Wave Nr. | | | I | II | III | IV |
| 5 | Time span K | | | 1760–1817 | 1817–1895 | 1895–1928 | 1929–1947 |
| 6 | Nested K | [1480] | | 1780 | 1840 | 1890 | 1940 |
| 7 | Phase trans. | | | 1880 | 1900 | 1929 | 1966 |

*Sources:* Table 2 for K-waves in rows 4 and Grinin, Grinin (2015, Table 4) for nested K-waves in row 6

Komlosy (2022: 38) parallels the production principles with Pierre Levy's conception of so-called anthropological spaces. Pierre Lévy (1997) identifies anthropological spaces and their specific mark-ers (distinctive cultural traits): The telluric space of nomads, the territorial space and its boundaries shaped by the agricultural PP, the space of commodities shaped by the industrial PP and the cyberspace (anthropological space of knowledge) shaped by the 'Cybernetic PP'. Each one of these anthropological spaces is identifiable by specific artifacts of knowledge (*e.g.*, geographical maps) as its distinctive traits (Lévy 1997: 221); a matter of anthropological history.

## The Lasting Impact of the Black Death

The Black Death was the bubonic plague, caused by the bacterium *yersinia pestis* (Perry, Fetherstone 1997; Hensch *et al.* 2010). It broke out at the beginning of the Little Ice Age (Preiser Kapeller 2021). The fourteenth century saw a slump in global population from *ca.* 425 million (= 425*10^6) people to less than 400 million by 1400 (Zinkina *et al.* 2019: 56). The shortage of workforce gave way to the development of essential machinery, new patterns of economic development and social reconfiguration. The established propellants for this resulting Production revolution are listed in Table 4.

*Table 4*

**The technological and economic innovations relevant after the 14th century Black Death**

| | Impacts | References |
|---|---|---|
| 1 | Sailing ships replacing galleys *etc.* | Belich (2016) |
| 2 | Water powered mills | Belich (2016), Mitterauer (2008) |
| 3 | Increased wages and migration to cities | Wickham (2018), Preiser-Kapeller (2021) |
| 4 | Modern state and bureaucratic governments in its infancy | Wickham (2018), Preiser-Kapeller (2021) |
| 5 | Mercenaries are replacing chivalry (knights) | Wickham (2018) |
| 6 | Popular Protest and Dissents | Tuchman (1978), Frankopan (2015) |
| 7 | Ships fit for deep sea navigation | Obenaus (2012, 2021) |
| 8 | Instruments for applied astronomy | Plachetka (2020b) |

*Source:* own arrangement.

Unlike the population, the Global GDP did not decrease between 1300 and 1400 CE (Zinkina *et al.* 2019: 56–59). The rise of per capita productivity to maintain the GDP volume compensated the diminish-

ing workforce before 1400, which can be explained by a production revolution, whose centers, that means, the focal areas of economic development in Europe shifted from the Mediterranean to a network whose nodes are located in Upper Italy, Upper Germany (especially Bavaria with Augsburg and Nuremberg), Flanders, and Lisbon (Komlosy 2022: 44). Such a spatial shift can be explained by applying network analysis to World Systems (Chase-Dunn *et al.* 2010) to trace the impact of new or alien ideas according to the definition of 'stimulus diffusion' (Kroeber 1940), whose sociological viability was assessed by Bargatzky (1978).

## MATERIAL AND METHODOLOGY

Survey studies and literature reviews along with conversations with local experts at places visited by Zhèng Hé were done in Indonesia from 2017 to 2019 (Plachetka 2019), in Santo Domingo due to Columbus in 2022 and in Austria until 2024. The findings are pieced together to reconstruct the network of stimulus diffusion by information flows during the period between Zhèng Hé and Christopher Columbus.

### Ming Admiral Zhèng Hé and His Legacy

The Ming Chinese Admiral Zhèng Hé (civil name: Mǎ Sānbǎo, 1371–1433 or 1435) became world famous due to his seven voyages across the Indian Ocean (1405–33). Anyway, Zhèng Hé had emigrants on board. The most important place to commemorate him is the San Poo Kong temple in Semarang, Java. The problematic Chronicles of Cirebon and Semarang represent vernacular historiography of regional Chinese communities (Wain 2017). Zhèng Hé officially endorsed the alliance between China with Melaka in what is now Malaysia and Samudera Pasai in North Sumatra, but he had patronage over the Chinese settlements (Kong 2015: 60–75). Networks of Chinese sojourners and settlers in South-East Asia (Reid 1996) may have informed the Venetian explorer Niccolo De'Conti in Java after Zhèng Hé's voyages (Baumgärtner 2003). Now they turn the pseudo-historian Gavin Menzies (2003) who claims that Zhèng Hé's fleets were the first to circumnavigate the world (rejected by Finlay [2004]), into a celebrity since the Zhèng Hé festival (*Imlek*) is re-established at the Sam Poo Kong in Semarang since 2005. Christylee, my colleague from Java and I attended the Imlek festival in 2019. The Chinese community of Semarang claims to have been established in the course of Zhèng Hé's voyages by a crew member who fell ill and stayed there with some friends. Menzies (2009: 141–154) claims that Italian pioneer Renaissance humanists such as Paolo dal Pozzo

Toscanelli, Nicolas de Cusa and Regiomontanus were inspired by the crew of some ships of Zhèng Hé's armada which had sailed to Italy. Braccolini and Toscanelli do mention envoys from China to Italy but no fleet. Zhèng Hé's present Indonesian fans, including Christylee, are not amused by such a critique.

In fact, Regiomontanus studied with the Austrian astronomer Georg Purbachius (*Georg Aunpekh von Peuerbach* May 30, 1423 – April 8, 1461) at the University of Vienna (Grössing 2002). An information flow from Southeast Asia to Italy was traced to assess its impact on the minds of Italian Renaissance humanists having formed a vibrant network.

A similar network of innovative minds promoted the adoption of the then New Information and Communication technology in Austria since 1997.

## Empiric Evidences from a Focal Group: Austrian Grass-Root Sociologists as Cybernetic Revolutionists

Austria (capital: Vienna, coordinates: 48°12′N 16°22′E) is a small alpine country that was on the semi-periphery of the World System (Wallerstein 1979: 95–119) before joining the European Union. Some early cybernetic revolutionaries there can be traced by a project sponsored by the European Commission (Municipia 1997) whose offspring is the research laboratory Globally Integrated Village Environment (GIVE), founded by the cyber-sociologist Franz Nahrada. It turned into the hub of a network of innovators, I was member of. We realized conferences from 2005 (Nahrada, Plachetka 2006) onward (Plachetka 2011: 14). Ecological villages should be made viable by mobilizing local renewable resources through global knowledge provided by information flows within a World System. Franz Steinwender (2005) inaugurated the implementation of this concept in the village of Kirchbach in Styria (coordinates: 46° 55′ 53″ N, 15° 39′ 44″ E) by a seminar center for online communication and education, the house KB-5, acting as an interface between the digital world (Internet *etc*.) and the anthropological space of territory to promote sustainable development by rural education (Peer 2007; Peer, Stoeglehner 2013). GIVE hosted an event in 2005 on employing specific Inca methods of ecosystem control to run their Vavilov center, as role model of scientific ‘urban agriculture’by crop biodiversity for sustainable settlements at large scale (Nahrada, Plachetka 2006; Earls 2006; Matteikat 2006). This conference tightened the links to Austrian political stakeholders in charge of promoting ways of sustainable development; among especially the organic farmers in the region ‘Vulkanland’, Kirchbach is situated in.

Disseminating these novelties was up to dissemination agents, in that case some organic farmers who are opinion leaders among their communities. They met at ‘centers of incubation’ such as KB-5 situated close to the area of implementation (Plachetka 2011: 14). In general terms, required to turn that show-case into a model, Bargatzky (1978) describes the social prerequisites of any successful ‘stimulus diffusion’ (Kroeber 1940) by dissemination agents ‘infecting’ local stakeholders.

## The Conception of Agent-Based Historiography in the Post-COVID Age

Bicher, Rippinger *et al.* (2020) have developed an agent-based model on the spread of the COVID-19 plague, which can be described by the metaphor of railroad travel. Their software for pest control considers the viruses as passengers, infected people as trains and their meeting points as railroad junctions where the virus can change trains, if the trains are not full. Full trains mean immune people. We apply that conception to trace the way in which European Renaissance humanists responded to the wider halo of information generated by the Zhèng Hé expeditions by adopting these novelties; making up their minds to realize new possibilities due to them. If several innovations are required to realize the new possibilities or objectives, the sum of innovation will cause at least a phase transition to a new phase in a PP's life-cycle. A full-fledged production revolution is indicated by distinctive traits of a forthcoming advanced anthropological space. Hyper-texts as books with references to other texts are considered as specific traits of the anthropological space of commodities (Lévy 1997: 221). The showcase for the early Renaissance transition is the Sacrobosco corpus containing Sacrobsosco's authoritative text on astronomy, and relevant works by Renaissance astronomers considered as comments edited in a single volume. This product of transition from a normative text (*e.g*. Confucius' works) to a hypertext, which means the reminder of a discourse, allows the identification of epistemological communities (Valleriani 2017) by network analysis (Valleriani *et al.* 2019). Since Renaissance humanists did not comment economic issues (Reinert, Fredona 2020), Komlosy's merger of Lévy's theory with Grinin's model recommends the history of map-making as a way to identify revolutionary centers. The Portolan map (Campbell 1987), drawn according to bearing lines is associated to the telluric anthropological space. Maps drawn according to the geographical latitude and longitude allow the exact representation of geographical borders (*e.g.*, a geographical longitude as the limit of Portuguese and Spanish spheres of influence, stipulated by the treaty

of Tordesillas in 1494) belong to the anthropological space of territory, medieval Portolan maps are usually considered as not suitable for (Alves 2013; Steinberg 2005).

A review of the European history of the fifteenth century 'instruments of knowledge', employed for navigation and map-making is to be put into the context of World System theory to identify clusters of Renaissance dissemination agents before 1492.

## Hints concerning a Spatial-Temporal Network Linking Zhèng Hé to Christopher Columbus

The literature review starts with Richard Hennig's anthology of the canonical documents on European discoveries before Columbus (Hennig 1956). Hamann (1968) juxtaposed the history of the Portuguese expansion (see also Halbartschlager 2021) with the history of cartography. The only explorer of Henry the Navigator's research program providing a survived report is the Venetian Alvise de Cadamosto, who reached the Senegal in 1455 and 1456 (Cadamosto 1837, 1989; Meloni 2013) but failed to circumnavigate Africa. Therefore, Portugal purchased Fra Mauro's map (Cattaneo 2003: 30). The map has a crucial message, transmitted from Indonesia: Africa can be circumnavigated, as was found out by *ca* 1420 CE (Plachetka 2019: 507–590); however, the Europeans had to find their own way. Since Lewis Hanke (1951) and Bucher (2006) rehabilitate Las Casas (1875) as a historian, his report on the emergence of Renaissance scientific geography which enabled Columbus to discover the route to America is to be taken into account. Anyway, the Portuguese envoy to negotiate the marriage between Emperor Frederick III of Hapsburg and the Portuguese princess Eleonora, financed the final edition of the map drawn by Fra Mauro (Falchetta 2013b: 43), the missing link between the expeditions of Zhèng Hé and Europe (Falchetta 2013b: 32). Fra Maruro drew the map according to reports and documents collected between 1447 and 1448 (Falchetta 2013b: 16). The authority on astronomy and geography stemming from the then adored Greek-Roman civilization was Claudius Ptolemy. His geography, based on longitude and latitude, came to Florence by 1397 (Egel 2014: 130). Dalché (2007) states that the Viennese mathematicians and mapmakers (Durand 1952) found their own way to mathematical geography. Therefore, we will present (a) the findings on some technical innovations relevant for Christopher Columbus, (b) links between Southeast Asia and Italy, ascribed to Zhèng Hé's voyages, to piece these findings together.

Concerning (a): Early European Renaissance humanists such as the Florentine astronomer Paolo dal Pozzo Toscanelli (Uzelli 1894;

Chiarelli *et al.* 1992) developed instruments for astronomical observations. It was Bessarion, the Greek delegate to the ecclesiastical council of Ferrara and Florence to put the Viennese professor Purbachius in charge to improve the astronomical data provided by Claudius Ptolemy's *Almagest* (Doppelmayr 1730: 3–5). Maps based on a grid of geographical latitudes and longitudes then updated, were eventually established in Florence by the mapmaker Henricus Martellius Germanus although World maps based on compass bearing lines as were portolans, prevailed as *carta maritima* for a while. Spectographic analysis of Martellius's map now housed in Yale reveals that he employed Ethiopian geography presented in the course of the ecclesiastical council of Ferrara and Florence (1431–1449) (Van Duzer 2013). A key document on Renaissance Humanists' believe in the reliability of their astronomical instruments for deep sea navigation across the Oceans is the letter by Jerome Münzer (*Monetarius*) to the Portuguese King (edited in: Hennig 1956: 236–239). Crowther (2020: Ch. 2.1.) elaborates Münzer's letter as a key document for tracing the technical application of Sacrobosco's cosmography. Hunter (2011) traces the background and impact of the letter: The globe maker Behaim should have been invited to King João II of Portugal through Münzer's intervention for demonstrating his globe as a mean to clarify how to sail westwards to China and Greater India, *i.e.* India and Southeast Asia. Sailors should use astrolabes and sundials for navigating uncharted seas. Instruments fit for that purpose had been developed only few decades before: Bartolomé de las Casas explains in detail the achievements of solar-based positional astronomy as a provision for the success of Christopher Columbus which Martin Behaim as a disciple of 'Monte Regio' (Regiomontanus) reportedly had introduced (Las Casas Lib. I, cap. 27 [1875: 213]). Behaim's importance for Portuguese deep sea navigation by applied astronomy was grossly overestimated (Markham 1915); however, Las Casas, quoting the Portuguese chronicler Barros, is explicit about the novelty of determining the geographical latitude by the Sun's altitude (Las Casas Lib. I, cap. 27 [1875: 213–214]): Regiomontanus studied in Vienna with the Austrian astronomer Georg Purbachius (Grössing 2002; Samhaber 2000; Zinner 1968) whose famous *New Algorithm of Planets* (*Theorica nova planetorum*) belongs to Sacrobosco's corpus of commentaries (Horst 2019). Sacrobosco and the Viennese school of mathematics, which considered astronomy as applied mathematics, became crucial for the construction of early geographical globes (Schmidt 2003: 80). Given the then grossly underestimated circumference of the earth, such globes became a crucial tool for demonstrating the rationale of sailing westward to East Asia to

politicians. The circumnavigation of Africa was not yet accomplished, while the credit crunch grew worse every day.

For a detailed investigation in Purbachius's achievements and impact, Christylee and I visited the little-known museum about Georg Purbachius situated in the town of Peuerbach (48° 20' N, 13° 46' E, 394 m.a.s.l.) from December 21st to 22nd Friedrich Samhaber (2000) showed us Purbachius' contribution to scientific navigation, especially his portable sundials which can be adjusted to the magnetic compass deviation. They have an integrated compass for adjusting them to the Meridian. Since the magnetic deviation was 10° southwest of the Meridian (the true North-South line) in Vienna during Purbachius' lifetime (Zinner 1968: 31), Purbachius' ruler to correct the compass deviation was imperative. Our survey clarified Münzer's claim that sailors should sail uncharted seas according to astrolabes and 'cylinders', which means portable sundials: No doubt that Purbachius' sundials were useful for navigation, no wonder that the Byzantine delegate to the council of Ferrara-Florence, Bessarion was deeply impressed by Purbachius' works and wanted to recruit him when he came to Vienna as a papal ambassador (legate) (Adam 1615: 4–5). The most important astronomic instrument of those times, the astrolabe, has programming disks (North 1974): Purbachius and Regiomontanus elaborated a new one to determine the true calendar date via the zodiac (Stoeffler 1594 [1513]: 135r) which demonstrates the technical applicability of Purbachius and Regiomontanus' astronomy.

Two years before Regiomontanus died, Paolo dal Pozzo Toscanelli wrote a letter to Fernan Roriz de Martins and inserted its copy into his letter to Christopher Columbus (Hennig 1956: 231–234) dated at June 25th, 1474. The letter explains Toscanelli's map to sail westwards to Asia sent in the attachment, but now lost. Toscanelli claims to have drafted this project by his talks with a Chinese ambassador to Pope Eugene IV (Las Casas lib. I, cap. 12 [1875: 92–93]). Henri Vignaud (1901) states that the letter is a forgery, but Markham (1903) and, based on the analysis of the survived copies of the letter, Altolaguirre y Duvale (1908) argued in favor of the authenticity of the letter, eventually confirmed by Hennig (1940), according to Kohler (2006).

Concerning (b): The available records of Zhèng Hé's expedition were written by Ma Huan (1970 [1433]) and Fei Xin (1996), two of his naval officers. Tan Ta Sen (2009: 164–165) provides a summary of all seven expeditions. Geoff Wade edited the *Ming Shi-lu*, (cited here as Ming Shi-lu online) mentioning Zhèng Hé in the entries to the following dates: December 18th 1412, October 10th 1415, December 18th, 1416, December 3rd 1421, July 16th 1421, June 29th 1430 and

March 20th 1431, concerning China's international relations. The Ming Shi-lu, whose online edition with a search engine was available in 2020 (I copied the relevant entries at once), provides the Chinese imperial perspective on Zhèng Hé's voyages. Zhèng Hé is called the 'Eunuch director' there, but the focus is on Samudera Pasai, the first Muslim polity in Sumatra and Malacca, a key issue to China (Wang 1992: 131–168), as its diplomatic relations with China had been established before Zhèng Hé's first voyage in 1405 and tightened due to Siamese aggression against Malacca. The Ming Shi Lu's entry (March 20, 1431) says that Zhèng Hé was ordered to stop the long-lasting Siamese aggression by harsh diplomatic means in response to Malacca's complaining at the Chinese court. In the year 1477, the Chinese official Liu Daxia ordered the records of Zhèng Hé's voyages to be locked away (Levathes 2014: 178–181), the year Donnus Nicolas Germanus made a terrestrial globe for the Vatican's library (Babicz 1987): Globes became crucial for making the 'Columbus plan' plausible.

After the Imlek of 2019, we visited the Cheng Ho Museum (https://www.gomelaka.my/cheng-ho-cultural-museum/) in Malacca, which displays Zhèng Hé's nautical map. It is a painted rutter (*periplus*) like the Roman Tabula Peutingeriana and no geographical map of the European portolan type, as established since the Carta Pisana (Campbell 1987; Pujades i Bataller 2013), suitable for a deliberate planning of trips. Since the Renaissance revolutionists were the only to struggle for the elaboration of maps and geographical globes drawn by longitude and latitude, whereas Asian maps such as the Kangnido map did not care about, chronology matters because this struggle started after Zhèng Hé's voyages: Falchetta (2013a, 2013b) linked the Map by Fra Mauro, Portugal acquired due to Cadamosto's failure, to Zhèng Hé's expeditions on the basis of circumstantial evidences, however, the Venetian merchant De' Conti (c. 1395–1469) is the only known person who is likely to have established a link between Zhèng Hé's voyages and Europe, as his account coincides with that of Ma Huan as observed by his editor, Mills (Ma Huan 1970 [1433]). In addition to, Pero Tafur (1874) recorded De' Conti's vernacular tales. When De' Conti, having returned to Italy, wanted to see Pope Eugene IV to confess his forced conversion to Islam in order to protect his wife and children on his return across the Red Sea and to return to Christianity, Pope Eugen IV ordered De' Conti to give an account of his journey to the papal secretary Poggio Braccolini, who states: '... [De' Conti] … discoursed learnedly and gravely on his journey to the most remote nations …' (Braccolini 1857: 1) when interviewed by humanist scholars in Florence between 1439 and 1442 (Egel 2014: 142). The Braccolini edition

of De' Conti's report mentions an envoy of Nestorian Christians from a ‘kingdom’ belonging to the Chinese Empire, but Braccolini was unable to have an in-depth conversation, as only Armenian interpreters were available (Braccolini 1857: 33–34).

## INFORMATION NETWORKS IN THE AGE OF REVOLUTION

Tamerlane's victory over the Ottomans at the Battle of Ankara on July 20, 1402 opened a window of opportunity for Europeans such as Niccolo De’ Conti to connect to the Maritime Silk Road (Lockhart 1986: 375). Zhèng Hé's rebooting the Maritime Silk Road, which had existed before (Wade 2009), caused the silver bullion famine, which means the aforementioned credit crunch (Frankopan 2015: 197; Atwell 2002), is the starting point of the scenario presented by Kohler (2006), who considers Columbus as having saved Europe from marginalization, but on the basis of Fra Mauro's map it was Zhèng Hé who presumably transmitted the decisive information to Italy that Africa could be circumnavigated, acting in the same way as Richard Sorge, whose radio cable from Japan informed Stalin, faced with the Nazi invasion, that Japan would not attack the Soviet Union. Since neither Zhèng Hé nor his deputies had radio, how did this cable, which changed the world, made its way to Europe? It is plausible to suspect Niccolo de’ Conti to have delivered it. Unfortunately Pero Tafur's record of De’ Conti's original narratives is confusing (Baumgärtner 2003: 287). On his return from India, De' Conti met Tafur at the Santa Catarina monastery on the Sinai peninusla (Tafur 1874: 95). De’ Conti claimed to have visited the realm of the legendary Prester John (Tafur 1874: 96). On his way home, De’ Conti sailed to Mecca (mentioning the tomb of the Prophet Mohamed [Tafur 1874: 108]) on a ship with 10 or 12 sails (Tafur 1874: 107–108) across the Red Sea (*mar vermejo,* which means scarlet sea). The cargo of these ships was handed over to caravans, which explains the presence of Zhèng Hé's fleet in Jiddah, sending envoys to Mecca during its eighth voyage. Conti's description of a ship of the size of a house rigged with eight to ten sails corresponds to the usual portray of Zhèng Hé's treasure ships, whose true size is disputed. Since de Conti gave a lot of papers to Pero Tafur, never mentioned since, it may be assumed that he knew much more than the survived records of his voyages allow to understand, but Fra Mauro’s map is to be considered as a knowledge aggregator (Nanetti *et. al*. 2015): Fra Mauro's crucial comments, transcribed by Falchetta (2006), are comments Nos. 19, 48, 49 and 53 (Plachetka 2019: 505–510): Comment No. 19 tells on the vessel that circumnavigated the southern cone

of Africa by circa 1420, when heading directly for the Cab Diab, obviously Madagascar (No. 48–49) thus Fra Mauro rejected the European authorities stating that the Indian Ocean is landlocked (No. 53) Ethiopian maps, the Ethiopian delegation brought to the Council of Ferrara-Florence, referred to Arabic maps (Falchetta 2013a: 32–35). Meanwhile, the nautical compass and astrolabe for mathematical geography became crucial for Portugal's expansion beyond Cape Bojador, the border of seas navigable by Mediterranean methods (Polonia 2022), In the absence of a predictable Monsoon wind, sailors had to leave the sea highway to Madeira and the Canary Islands to sail northwards to sail home by the West Wind drift (Figure 1).

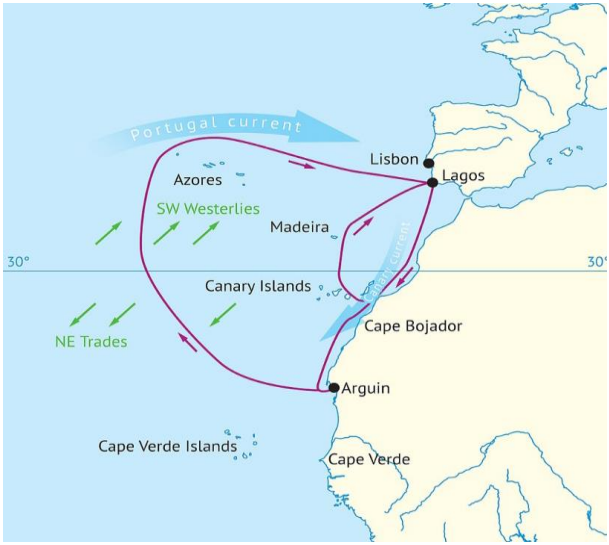


**Fig. 1. Volta do mar as the method to get home from Africa**

*Source:* https://en.wikipedia.org/wiki/Volta_do_mar.

The monsoon trade winds in the Indian Ocean made navigation easier. Due to the changes in the monsoon winds, ships sailed from the Persian Gulf to the Indian West Coast with the South-West- and back with the North-East Monsoon, whose change happens during the typhoon season. Therefore ports in South India and Ceylon where a political pivot, as sailors had to await the end of the Typhoon season. A nonstop voyage from *e.g.* Oman to Sumatra was hardly possible during a single monsoon season (Munoz 2016: 68–71).

Southeast Asian's inter-ocean – 'Mediterraneity' (Wang 2012) between China and India shaped Indonesia's trade and domestic politics

(Hall 2016). The Mongol invasion of China gave way to the unification of almost all of Indonesia by the Majapahit Empire (Munoz 2016: 78). The commercial expansion of the Islamic world created new political facts, Zhèng Hé had to face. Recent research, presented by an event of the Indonesian Heritage Society's Night Study Group at September 19, 2024, questions the absence of the Majapahit navy on Zhèng Hé's arrival. Ming diplomacy requires a detailed analysis, whereas the ecclesiastical Council of Ferrara-Florence established a hub of geographic information networks for humanists (O'Doherty 2011), Fra Mauro had access to (Baumgärtner 1998). Piccolomini sent Fernan Martins, a friend of Nicolas da Cusa (Apfelstadt 1992) as a dissemination agent of Renaissance humanism to Lisbon (D'Arienzo 2006). It was just Columbus who ventured the realization of this humanist project to establish a direct access to the Maritime Silk Road expected to put an end to the credit crunch. The grossly underestimated circumference of the earth was not Columbus' fault and America was not on anyone's agenda.

## ESTABLISHMENT OF THE NETWORK ACCORDING TO THE CRITERION OF PLACE AND AGENT

The edges and nodes of the networks, ignoring the elapsed time, are sorted out in Table 5.

*Table 5*

**Geographic nodes as 'junctions' where information 'changed trains' at**

| Nr. | Places | Actors | Contact agents (supposed) |
|---|---|---|---|
| 1 | Indonesia | Zhèng, sojourners, settlers | Conti |
| 2 | Hormuz | Zhèng Hé | Arab Traders |
| 3 | Mecca | Zhèng's envoys | Conti |
| 4 | Sinai | Conti | Tafur |
| 5 | Ferrara | Tafur, Pope Eugen IV and the Chinese envoy (?) | Tafur, Pope Eugen IV |
| 6 | Florence | Pope Eugen IV, Toscanelli, Chinese envoy | Mauro, Bessarion to Vienna |
| 7 | Venice | Conti, Mauro, Asian sailors | Conti, Toscanelli, Piccolomini |
| 8 | Vienna | Piccolomini, Purbachius | Martins to Lisbon, Regiomontanus |
| 9 | Nuren-berg | Regiomontanus | Behaim to Lisbon |
| 10 | Lisbon | Martins, Behaim | Toscanelli, Columbus, Münzer |
| 11 | Spain | Columbus | Las Casas (as biographer) |

Crucial manuscripts by Purbachius and Regiomontanus were preserved just in the Fugger library before being filed in Vienna (Purbachius n.d.), which matters as the economic activities of the Fugger even influenced geography (Lehmann 2020). Therefore we will focus on the nodes (8–11) because Maximilian I, as Münzer's ghostwriter, claimed his over-lordship over the XVc islands (Kleinschmidt 2019: 315–318), possibly claiming clandestinely the archipelagos of insular Southeast Asia. However, both, Maximilian and Columbus reckoned without the host, Portugal: The Castile succession war ended by the treaty of Alcáçovas (September 4, 1479) establishing Portuguese and Spanish spheres of influence in Africa. Diogo Cão's subsequent expeditions to test the new astronomical methods were crucial for Diaz' and Vasco da Gama. Therefore Portugal simply could not realize any project that seeks a route to East Asia, sailing westward. The circumference of the earth was grossly underestimated not only by Columbus but even by the famous Waldseemüller map, Schoener turned into a geographical globe (Maruska 2012).

The resulting network of innovators is quite simple, see Figure 2. Directed sub-graphs (arrows) are light, non-directed graphs are bold, but it is only a draft of the spatial-temporal network.

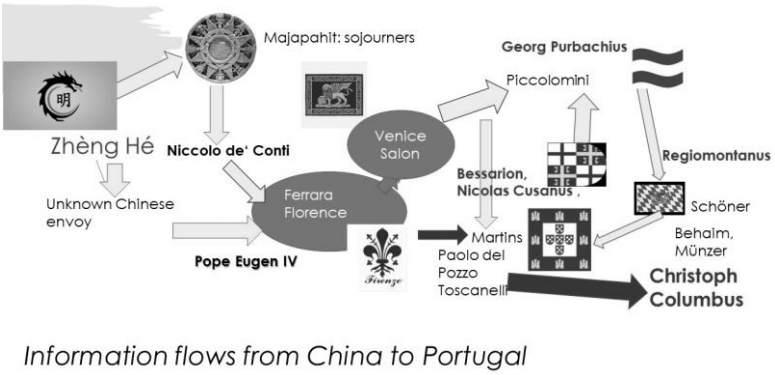


**Fig. 2. The information flow from China to the early European humanists before Columbus**

*Source:* Own draft, the flags are indicating the places of the nodes, bold arrows are undirected graphs, light arrows are directed graphs Table 4.

The formula for calculating the number of edges in a complete graph of such a simple network is given below (Equation 1):

Equation 1: $E = (n*(n-1))/2$

In Equation 1, E is the number of edges and n is the number of nodes of that reconstructed network. We dare to assume unknown communication between Europe and China due to the fact, that Zhèng Hé's records were banned in 1477 only 3 years after Toscanelli's letter on the so-called Columbus plan. Substituting n = 11 in the formula, we get 55 edges of a fully connecting graph. The super-spreader in this network was the Ecclesiastical Council to link scholarship to policy makers. According to the model rationale of Szell *et al.* (2010) each interaction event means an edge, which may explain the 55 edges. In this network, Pope Eugen IV, Bessarion, Piccolomini, who turned Martins into a dissemination agent, and Maximilian I, the ghostwriter of Münzer's letter are the political stakeholders. As mentioned, Renaissance humanists remained tacit on economic issues, so economic stakeholders are not mentioned. Atwell (2002) reveals the shortage of silver strangulating new and emerging business models propelling the Production Revolution. As the economy was based on silver 'bullionism', Europe faced the credit crunch and Southeast Asia a shortage of cash money (Lieberman 2003: 140). Population growth, expected to change the socio-cultural configuration (Grinin, Grinin 2015) started by 1400 after the demographic slump since 1300 (Zinkina *et al*. 2019: 56), explaining the delay between the plague and the spread of the Renaissance Revolution. The network (Figure 2) coincides with the phase transition itemized in Table 4. Bargatzky's (1978) detailed analysis highlights challenged authorities welcoming novelties they can turn into their assets: Garner (1990) could have been more explicit on the Renaissance Revolution.

## CONCLUSION: TAKE HOME LESSONS FOR THE CYBERNETIC REVOLUTION

Zhèng Hé had rebooted the Maritime Silk Road up to the point where it could be managed by the Chinese diaspora themselves. In main-land China, the 'civilized' class was the shì class, government func-tionaries within China's political sphere since the Song dynasty, whose Confucianism and the famous examination system of the Chinese civil service were intended to shape a corporate shì identity. They formed a specific epistemological community (Schäfer 1985: 82–85). The Song dynasty was established in 960 CE during Europe's Dark Ages. Here we are talking about the Renaissance: China's turn inwards after Zhèng Hé's last expedition in 1433 was a governmental issue (Belich 2022: 230–233) to fence off overseas trade by establishing special trading ports, leaving the Chinese diaspora disenfranchised. Although

they became a vulnerable minority, they adopted a ‘vernacular cosmopolitanism’ (Hew 2019: 31–37). Eventually, neither the indigenous Indonesian population nor the Dutch colonialists in Indonesia reportedly could cope with their wealth (Furnival 2010 [1939]: 409–414), however the issue of the Chinese minority is not always amusing to Indonesians. Furnival's notes suggest that China has been outsourcing her production revolutionists since 1477. In Europe, Nicolas da Cusa initiated the emancipation of political theory from theology at the Council of Basel (Wickham 2018: 372). The rationale of politics emancipated itself from the constant need of proving its ideological legitimacy, a pivot of Southeast Asian indigenous states, whose royalty and nobility had to enact the dominant worldview (the Spanish term cosmovisión is more appropriate for its semantic halo) as if they were professional actors, leading Geerts (1980) to coin the term ‘theater state’. Some kings, avatars of Hindu deities, were obliged to follow the theater script to such an extent that they did not dare to leave their palaces as sacred centers to avoid their seizure by usurpers (Heine-Geldern 1956: 11). Lieberman (2003: 33) prefers the term ‘solar states’. Burckhardt (2019 [1869]: 4) says that the modern, secular state emerged in Italy as a matter of fact, not of collective representations or ideology, since any ideological hegemony was broken by the rivalry between the Hohenstaufen emperors and the papacy. These secular states gave way to the Renaissance, which emerged from Italy after the Black Death, propelled by Renaissance humanism. Purbachius's biography is that of a hillbilly of Upper Austria thriving on Italian humanist cultural capital as a visiting professor in Padua, Bologna, and Ferrara, where Pero Tafur (1926: ch. 21) had met both, Pope Eugene IV and the Byzantine Emperor before Purbachius even met Nicolas da Cusa, in Rome (Horst 2022: 20), acquiring brand-new cultural capital. Returning to Vienna, he lectured on Latin literature and exact astronomy, eventually becaming astronomer at the court of Frederick III (Samhaber 2000), having won Bessarion's favor. Enea Silvio Piccolomini was a democratic revolutionist in Basel, like Nicolas da Cusa before him. It was just Piccolomini to become Pope due to his skills as a Renaissance Humanist. Bessarion, the representative of Byzantine Orthodoxy at the Councils of Ferrara and Florence, became a Catholic Cardinal due to the same skills. Such political careers are possible only during a revolution.

The ‘revolutionary cluster’ in Kirchbach, equipped with the cultural capital of Nahrada by pioneers such as Douglas Engelbart (Matteikat 2006: 1), became a role-model for rural education to pro-

mote the ‘turn towards sustainability’ for a while. The Covid-19 plague puts an end to that kind of ‘cyber-optimism’: Komlosy (2022) expects a leverage effect of the lock-downs due to pest control, forcing new markets for digital services and the dominance of digital forms of economic transactions, which are not welcomed by everyone, similar to the problem of dictators in the final phase of revolutions (Grinin 2010: 126–127). In terms of PPs, a revolutionary focal cluster turns into a dominant epistemological community to impose at least a phase transition: Piccolomini's (1477: [1–2]) rhetorical barrage against people of ‘vulgar mindset’ raises the question: who were those vulgar minded people? Since the fate of a revolution in its advanced phases cannot be predicted, it depends on skillful leadership (Grinin 2010: 125). In Europe, the labor shortage caused by the Black Death left no alternative to the Production Revolution, however, the subsequent credit crunch was about to strangulate the economic agents propelling it. Protestantism, as the ideology of the revolting peasantry, may have been the opposition to the Renaissance Revolution, once refinanced by looted American gold and silver.

If the Cybernetic Revolutionists establish an ‘elite rule’ per se, they should remember the fate of China ruled by imperial bureaucrats (the shì class): The humiliation of China since the Opium Wars against British drug traffickers is a dire warning to any society that prioritize codified norms under the aegis of a specific epistemological community over traditional ethics, rooted in people's vivid cultural traditions. Codified norms, as always challenged by ‘vulgar facts’, will justify any disenfranchisement of citizens due to their alleged ‘vulgar mind-set’, for example, of those Chinese commoners who can recognize a British gunboat but cannot legitimize their observation by quoting an adequate academic Confucian proverb.

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