### Modern forms of work

### A European comparative study

edited by Stefano Bellomo and Fabrizio Ferraro



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# 7. Blockchain and the algorithm in the employment relationship

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#### **Premise**

Technological evolution has been dramatically transforming labour law in recent years. The digitalization of production and the introduction of smart devices within traditional production models have had a considerable impact not only on the organization of work but also on the enhancement of the technological skills of employees<sup>1</sup>.

Recent years' progress of scientific and technological research has indeed created increasingly refined forms of production and work organization, the aim of which is the implementation of efficiency and business results through the enhancement of workers' technological skills<sup>2</sup>. An objective pursued through the rational organization of work

As is well known, there are many factors that affect labour productivity, such as the "capital equipment" made available to the worker and the "total factor productivity", in addition, of course, to the service provider's activity. In this regard, please refer to L. Costabile, Glossario dell'economista per il giuslavorista, in Rivista giuridica del lavoro, 2009, I, 183.Recently, see M. Piva – M. Vivarelli, Innovation, jobs, skills and tasks: a multifaceted relationship, in Giornale di diritto del lavoro e delle relazioni industriali, 2018, 3, 159, 599.

On the evolution of technologies, methods of production and methodologies of work organization and their effects on work, with particular reference to the reduction of working hours, see S. Bellomo, *Trasformazione del lavoro e tendenze attuali della contrattazione collettiva: l'esempio dei nuovi accordi sull'orario di lavoro*, in *Il diritto del mercato del lavoro*, 2018, 3, 697.

within the company, but also and above all through the integration and, in several cases, the replacement of individual work with the work of the machines<sup>3</sup>.

Nowadays, in digital production systems, the organization of work is often entrusted to an algorithm<sup>4</sup>, which supports the entire digital infrastructure, as in the blockchain system, and promotes disintermediation in the meeting between job demand and supply, identifying the worker most suited to carrying out the tasks required according to a digital recruitment mechanism, based on transparent and immutable data. And through smart contracts, moreover, it is possible to streamline the legal relationships on which the company is based to improve efficiency and simplify relations with workers, customers and suppliers.

Aware of such changes, national governments are recently starting to introduce reforms to support the digitalisation of the production system, in order to prevent the apparatus of protection of the worker and industrial relations from being overwhelmed by the speed with which scientific innovation is shaping the work relationship<sup>5</sup>.

A change of perspective is therefore necessary as it moves from the urgency of bringing the worker's traditional protectionist vocation closer to the changes that digital technology today brings to working reality<sup>6</sup>.

The issue of integrating the worker with the machine would deserve a separate discussion in order to be appreciated in its complexity. We merely recall here the illuminating contribution by V. Maio, *Il diritto del lavoro e le nuove sfide della rivoluzione robotica*, in *Argomenti di diritto del lavoro*, 2018, 6, 1414.

On the meaning of the term algorithm, see P. Domingos, *The Master Algorithm. How the Quest for the Ultimate Learning Machine Will Remake Our World*, Allen Lane, 2015.

For example in Germany, with Arbeiten 4.0, launched on the basis of the indications of the Green Book of the Ministry of Labor and concluded, after about a year, with the adoption of a White Paper, there has been a social dialogue on the issues of worker participation and their involvement in quality of employment issues following recent technological innovations. In France, the unions have drawn up, both jointly and independently, a large series of reports and recommendations on the subject of digitization, IT transformation of production systems and quality of life and work. The aim is to analyze and prevent, in order to offer a prompt solution, the effects on the employment contract of digitalization, which are detected with reference to the workplace, working times and the characteristics of subordination. For further information on the subject, see the CISL report, *Una via italiana a Industria 4.0 che guardi ai modelli europei più virtuosi*, Rome, 13 March 2017.

For wide-ranging considerations on the interactions between contract and company organization, please refer to M. Persiani, *Contratto di lavoro e organizzazione*, Padova, 1966. Recently, see M. Franceschetti – D. Guarascio, *Il lavoro ai tempi del management algoritmico*, in *Rivista giuridica del lavoro*, 2018, 4, 705.

#### Digital innovation and labour market

It is undeniable that technological evolution plays a prominent role in the adaptation of traditional labour law categories to the historical context as well as in the awakening of industrial relations, often overwhelmed by the speed with which scientific innovation shapes the employment relationship<sup>7</sup>.

The evolution of technology has created increasingly refined forms of production and work organization, whose aim is the implementation of efficiency and business results through the enhancement of workers' technological skills. An objective to be pursued through the rational organization of work within the company, but also through integration and, in some cases, the replacement of individual work with the work of machines<sup>8</sup>.

Just a few months ago the European Commission declared that the European Union intends to create new professional skills and update existing ones. In other words, renewing the labour market to enable it to keep pace with technological evolution.

According to EU data, the demand for digital workers is on a solid growth track. Over the last years investments in ICT to improve efficiency or business volume increased but 43% of Europeans do not have basic digital skills, as "they cannot search for information on the web, send emails, make video calls, shop or pay their bills online". And 90% of jobs, in all sectors of business, require digital skills, but 35% of the labour force doesn't have basic digital skills.

Nonetheless, 53% of companies looking for ICT specialists report difficulties in recruiting them and, still today, there are 1 million open vacancies for ICT experts in the European Union.

Most of all, most of workplaces have not taken any action to tackle the lack of digital skills of their employees, likely in consideration of the high costs that would be encountered when undertaking actions to deal with digital skills gaps.

With reference to the genetic mutation of labour law see V. Speziale, *The genetic mutation of labour law*, in WP CSDLE "Massimo D'Antona" .it – 322/2017, 2.

See J. Rifkin, The End of Work – The Decline of the Global Labor Force and the Dawn of the Post-Market Era, 1995, ed. Putnam Publishing; R. Donkin, The Future of Work, 2010; J. Kaplan, Humans Need Not Apply: A Guide to Wealth and Work in the Age of Artificial Intelligence, Yale Un. Press, 2015.

Data returns a picture of the labour market that is highly deficient with respect to the themes that already influence the working reality.

The fourth industrial revolution<sup>10</sup>, that of the use of intelligent machines, interconnected and connected to the internet, and now also of blockchain and smart contracts technology, inevitably imposes on national economies a solid commitment in plans for re-industrialization and investments in 4.0 technologies.

The aim is to allow companies to resist to the competition of foreign economies at the forefront of scientific and technological research.

When we talk about technological evolution of course we refer to artificial intelligence, automation and robotics. These technological advances are able to create new jobs as countless opportunities lie ahead, but they can also create huge job losses.

Technological changes are dynamic processes and simultaneously involve the creation and destruction of jobs as well as the transformation of existing jobs. Both these elements have critical implications for workers and employers and, in the long time, tend to have effect also on their families.

This revolution, though, is having a transformative impact on the world of work.

Some observers are concerned that these changes may lead to a "race against the machine" or in a "jobless future", as almost surely today's skills won't match the jobs of tomorrow and probably new acquired skills will quickly become obsolete. So huge investments are needed in order to enable workers to thrive in the technological age.

<sup>&</sup>lt;sup>9</sup> European Union Report, *Digital skills for all Europeans*, 2019, available at https://ec.europa.eu.

The first to talk about a c.d. fourth industrial revolution was the World Economic Forum, *The future of Jobs. Employment, Skills and Workforce,* 2016. The expression is commonly used to refer to the production and organizational system based on the connection between physical and digital systems, based on the use of big data in a global competitive horizon. Otherwise, the third industrial revolution descended from the creation of industrial robots and computers, while the second and first were born, respectively, with mass production and the assembly line and with the use of machines powered by mechanical energy. On the link between the fourth industrial revolution and changes in the labor market, see S. Caravella, M. Menghini, *Race against the Machine. Gli effetti della quarta rivoluzione industriale sulle professioni e sul mercato del lavoro*, in *L'industria*, 2018, 1, 43.

E. Brynjolfsson, A. McAfee, Will humans go the way of horses, in Foreign affairs, 2015, 8 ss.; Id., The second machine age. Work, progress and prosperity in a time of brilliant technologies, W. W. Norton & Co Inc., 2014.

R. Ford, *Rise of the Robots: Technology and the Threat of a Jobless Future*, New York, 2015.

The peculiarity of the current technological change is that the growth in automation is combined with the competition that characterizes the context of globalization<sup>13</sup>.

As a result, enterprises are under strong pressure to reduce costs while intensifying productivity. The new manufacturing technologies leading to Industry 4.0 are expected to introduce new production models that can create opportunities for workers as well as for enterprises, enhancing productivity and competitiveness.

As it has been highlighted, repercussions of many of these technological developments are already being felt today, but many of them are still to be felt in current production models and labour systems. How quickly and broadly these developments are adopted and how quickly they can impact business models, will undoubtedly shape the stability or volatility of future labour markets<sup>14</sup>.

## Inside blockchain: distributed ledger technology and miners

The anglo-saxon term "blockchain" is intended to refer to a new organizational paradigm of exchanges and data between subjects belonging to the same network, whose ductility was not slow in highlighting the multiple uses that such a technology is suitable for covering in different sectors of the legal system<sup>15</sup>.

On the complex relationships between market globalization, international competition and wages see M. Martone, *A che prezzo*, Rome, 2019. For a general analysis of the effects of economic globalization see D. Acemoglu , J. A. Robinson, *Why Nations Fail, The origins of Power, Prosperity, and poverty,* New York, 2012; D. Rodrick, *La globalizzazione intelligente*, Roma – Bari, 2011, 151 but also Id., *Dirla tutta sul mercato globale*, Torino, 2019; S. Sassen, *Globalization and its discontens. Essays on the new mobility of people and money,* NY, 1998. On the effects of globalization on labour law see M. Revelli, *Globalizzazione e trasformazioni del lavoro*, in A. Sasso, S. Toselli (a cura di), *Cultura e identità nella scuola che cambia. Tecnologie. Sapere. Lavoro. Cittadinanza*, Bologna, 1999; V. Speziale, *La mutazione genetica del diritto del lavoro*, cit., 2.

See World Economic Forum White Paper, Eight Futures of Work Scenarios and their Implications, January 2018, 2.

As is known, the critical issues related to the spread of scientific and digital innovation are not exclusively labour law, but affect almost every sector of knowledge. *Ex plurimis*, see A. Stemler, *Betwix and between: regulating the sharing economy*, in *Fordham Urb. Law Journal*, 2016, 3143; A. De Franceschi, *The adequacy of Italian Law for the Platform Economy*, in *EuCML*, 2016, 1, 56.

When we talk about blockchain we talk about an innovative and safe technology that, through the paradigms of the cryptography, creates a chain of blocks, each of which represents an exchange, a transaction, shared and validated by the entire network. So it is a distributed and public ledger that is immutable, except with the consent of all the participants, and that carries out transactions in a transparent and secure manner because every member of the network can control every exchange in every moment.

The chain of transactions that makes up the blockchain is not static, but changes rapidly, following the pace of transactions made by the participants.

For a new block to be added to the blockchain, the transaction must be validated by solving a complex mathematical problem against payment of a price. This activity is called mining and is carried out by particular types of subjects, the miners, whose performance is remunerated and is, indeed, strongly encouraged through the free determination of the amount paid for the resolution of the mathematical problem<sup>16</sup>.

It is immediately intuitive that the work of the miners is essential to the survival of the system, given that, thanks to their commitment, the transactions carried out by the participants are validated and the chain of blocks in which they are enclosed is continued.

Obviously, each blockchain system calibrates the difficulty of the algorithm increasingly, in relation also to the number of participants in solving the mathematical problem.

If the transaction verification process detects an error, it ends unsuccessfully. In this case, not only the new block cannot be created, but every person in the network is aware of the failure to authorize the transaction.

Otherwise, if the validation of the transactions is successful, a new block is created, which is added to the already existing chain. In other words, a transaction recording is created that is public, as it is visible to everyone, permanent and immutable, provided that no participant in the blockchain will be able to modify or even delete it from the chain.

In other words, mining is the process of solving the mathematical algorithm called proof of work, given that the first miner who manages to solve this algorithm, proving that he has employed resources to achieve this goal, communicates the solution to the other players in the chain. The price for mining depends on multiple factors, and is in particular determined by the amount of commitment, the processing capacity and the economic availability of the subjects who invest their time in solving the problem.

Of course, the great absentee, in such a well-conceived system, is the central authority, that is the subject delegated to the control of the correctness of the transactions, now replaced by the generalized and distributed control of all the participants of the network.

# Towards a legislative definition of blockchain in the Italian legal system

Aware of these changes, the European Union on the one hand, with the resolution of the European Parliament of 3 October 2018 "Distributed and blockchain registry technologies: creating trust through disintermediation", and the national governments on the other hand are introducing the first interventions in support of the digitalization of the production system, in order to avoid that the worker's protection apparatus and industrial relations are overwhelmed by the speed with which scientific innovation is shaping the employment relationship more and more rapidly.

At European level, the creations of the EU Observatory and Forum on the Blockchain should be remembered, inaugurated by the European Commission and with the support of the European Parliament, as well as the European Blockchain Partnership, an organization to which all European countries belong.

In Italy, we started to talk about blockchain when, with reference to cryptocurrencies, the Bank of Italy attempted to provide a first definition of cryptoactivity within the "Financial Stability Report no. 1/2018", in order to avoid inconsistencies with respect to the definition of currency with legal tender status. Thus, he elaborated a definition of cryptoassets, namely "digital activities whose transfer is based on the use of cryptography and Distributed Ledger Technology". Some of these cryptoactivities, including Bitcoin, continues the Bank of Italy in accordance with the orientation adopted by the European Central Bank, are commonly identified as "virtual currencies", given that they do not perform the economic functions of the currency nor integrate the currency from a legal and legal point of view<sup>17</sup>.

And indeed, the Bank of Italy specifies in the same Report that "Currently technological limits contribute to making the use of cryptoactivity as payment instruments inefficient. Use in wholesale payments is hampered by uncertainty about the costs associated with the individual transaction and execution times". Furthermore, "Cryptoactivities do not confer rights of an economic nature (such as the payment of coupons or dividends) and do not represent liabilities of an issuing

The norm, if on the one hand represents a first timid attempt to define the phenomenon of cryptoactivity, on the other it does not provide a solid technical and legal structure to which to refer in the interpretation of the blockchain phenomenon.

Nor does help seem to come from the latest European anti-money laundering directive, which, while attempting to regulate virtual currencies, at least from a criminal law point of view, limits itself to laying down obligations on the Member States which, however, do not provide no precise legal indication regarding distributed ledger technology<sup>18</sup>.

Thus, the italian legislator has eventually noticed the economic potential and the legal relevance of the blockchain phenomenon which, in order to realign the Italian legislation to that of the competing economies that have already begun to explore the uses of this technology, has provided for the first time, a definition of distributed ledger.

In particular, pursuant to the first paragraph of art. 8 ter of the legislative decree n. 135 of 2018, converted with amendments into Law no. 12 of 2019, for "technologies based on distributed registers", we mean "computer technologies and protocols that use a shared, distributed, replicable, simultaneously accessible, architecturally decentralized register on cryptographic bases, such as to allow registration, validation, updating and storage of data both in clear text and further protected by cryptography verifiable by each participant, which cannot be altered and cannot be modified"

This is a first nuclear intervention that recognizes legal dignity to the phenomenon of registers distributed in the exchange of data within a virtual network. A legal framework of distributed ledger technology, albeit still primordial, which represents a leap forward towards the definition and recognition of technological phenomena attributable to blockchain technology from which, in the near future, a real regulation could arise, under the profile not only civil law, but also and above all labor law, corporate and tax law of the distributed ledger phenomenon.

institution" and their purchase is therefore motivated "mainly by expectations of price increases, a typical mechanism of speculative bubbles".

The reference is to the directive of the European Parliament and of the Council 2018/843 of 30 May 2018, which amends the European Union directive 2015/849 concerning the prevention of the use of the financial system for money laundering or terrorist financing purposes and which amends the directives of the European Union 2009/138 / CE and 2013/36 / UE.

#### **Smart contracts**

The use of blockchain technology could have even more disruptive effects if accompanied by a wise use of smart contracts, that use digital technology innovations to simplify and accelerate the traditional path of contract stipulation.

It is not by chance that the italian legislator, with the aforementioned art. 8 ter of the d. L. n. 135 of 2018, immediately after naming the distributed registers and therefore recognizing them as legally relevant, he took care to provide a definition also of the so-called smart contracts.

Pursuant to the aforementioned legislative provision, in fact, "a smart contract is defined as a computer program that operates on technologies based on distributed registers and whose execution automatically binds two or more parts on the basis of effects predefined by the same".

The peculiarity of smart contracts is that, although they refer to the concept of contract in the name, they differ from the juridical conformation of the latter under different profiles. In them the concept of agreement extends and takes the form of a pact between several parts written in a programming language.

Aware of the complexities and systematic criticalities that the adoption of such a tool to circulate the will of the parties is capable of introducing into our legal system, the legislator is concerned with specifying that "smart contracts meet the requirement of the written form after computer identification of the interested parties, through a process having the requirements set by the Digital Italy Agency with guidelines to be adopted within ninety days from the date of entry into force of the law of conversion of this decree".

Inside production models, smart contracts may have considerable potential.

The most striking effect of the use of smart contracts, which at the occurrence of predetermined conditions put in place the pre-established effects, is in fact the radical streamlining of some segments of the productive and organizational activity of the company. Hence the remarkable speeding up of production and, therefore, of the exchange of goods and services.

In fact, the transparency that characterizes blockchain technology would represent a very useful tool for assessing the reliability of the worker and, at the same time, his experience and competence in a given professional field, comparing previous work experiences with that of new potential stipulation.

Furthermore, the publicity of the blockchain register would allow to prevent or in any case limit the hypotheses of irregular work, as such they cannot be registered in the blockchain on which the professional career of the worker would be recorded.

These are some first considerations on the potential interactions between two phenomena, blockchain and Industry 4.0, which are already conditioning the working reality through their potential as tools for organizing companies and markets.

Moreover, smart contracts are able to manage data, including lists of people who will participate in a given vote or the criteria for building the voting system in a certain organization. In the smart contract it is therefore possible to define the rules to which the participants must adhere in the vote, given that the smart contract is a program that carries out operations unalterably with respect to that established at the time of programming.

The direct effect of this voting system is the immediate controllability of the election and its result, which will be automatically implemented in its entirety to the achievement of 50% + 1 of the participants. Voting systems based on blockchain technology could therefore be used to reinvigorate union voting systems and, due to their effect, industrial relations. The future of union democracy could in fact pass through digital voting systems and rules, such as to guarantee maximum transparency and the full participation of the workers involved<sup>19</sup>.

Anyway, it must be considered that the applications of the smart contract in the employment relationship may currently be limited: the assumption on which the smart contract is based is the condition of equality of the subjects, which is not present in the employment contract.

Moreover, in labour law what matters is not the contract but the employment relationship, that is, not what the parties say to each other but how the relationship is actually posed. In the employment contract, moreover, there is still a duration relationship, in which what is agreed at the initial moment then changes, also for reasons other than

Such a system is already being developed by the Italian Union trade FIM, which intends to become the promoter of a digital voting mechanism for union trade representatives inside the company (RSU). The aim of the project is to respect the certainty and secrecy requirements of the vote together with those of immediacy of the result, avoiding the spread of phenomena of little transparency in the election results. On this regard see S. Tagliavini, *Blockchain: un nuovo paradigma di democrazia* (sindacale), in *Bollettino Adapt*, 2018, 30.

the will of the parties. So from a contractual point of view, on the one hand there is the obstacle of equality of the parties and on the other that of the mandatory nature of the law.

### The impact of distributed ledger technology on the world of work

The complexity of the blockchain phenomenon imposes some considerations about the potential effects on the work of the processes of digitization of production systems and working relationships, given that technological innovation represents a challenge for the economic and labour law system in terms of the future sustainability of the change introduced<sup>20</sup>.

The fear is, on the one hand, that of the potential elimination of numerous jobs, given that every technological change has a strong impact on employment levels. On the other hand, that of the qualitative transformation that work performance can undergo. Which testifies to the significant destabilization that the technological and scientific evolution of recent years has been able to bring to our legal system<sup>21</sup>.

For these reasons, it is not surprising that, from the progressive awareness of the radical change that is transforming the economic and working reality, to those who foresee a significant progress in the labour market, in terms of greater efficiency of companies and greater competence and professionalism of individuals<sup>22</sup>, contrast those who, on the other hand, show concern about the considerable changes that digital innovation in the economy and labour is destined to bring to the workforce<sup>23</sup>.

Truth is that it is likely that the diffusion of blockchain technology must be perceived as a chance for the creation of new job opportunities, able to contribute to taking care of the emergence of work that

Con riferimento alla durata ed alla intensità del lavoro *online* si veda W. Daubler, *Challenges to Labour Law*, in A. Perulli (a cura di), *L'idea del diritto del lavoro*, *oggi. In ricordo di Giorgio Ghezzi*, Cedam, 2016, 497.

For a wide-ranging vision on the topics of automation, artificial intelligence and safeguarding "human" employment levels, V. De Stefano, *Negotiating the algorithm: automation, artificial intelligence and labor protection,* in International Labor Office, 2018.

<sup>&</sup>lt;sup>22</sup> R. Ciccarelli, *La rivoluzione dei lavori*, in G. Allegri – G. Bronzini, *Libertà e lavoro dopo il Jobs Act. Per un garantismo sociale oltre la subordinazione*, Derive Approdi, Rome, 2015, 142.

<sup>&</sup>lt;sup>23</sup> C. Degryse, *Impacts sociaux de la digitalisation de l'économie*, in WP ETUI, 2016, 2, 9; J. Drahokoupil – B. Fabo, *The platform economy and the disruption of the employment relationship*, in ETUI Policy Brief, 2016, 5, 2.

plagues the current condition of the labour market, above all national, through the creation of figures specific professionals<sup>24</sup>.

As carefully observed, one of the most evident effects of the digitalization of socio-economic and working relationships is constituted by the considerable reduction of transaction costs<sup>25</sup>, made possible by the construction of a communication system that favors the meeting between the worker and the user of the service<sup>26</sup>.

Due to the worldwide distribution of the blocks that make up the chain, blockchain technology creates a system of encounter between labour supply and demand "peer to peer", with relationships of a horizontal nature, which arises as an alternative to the traditional mediation system in the meeting between those who perform their work and those who request it.

So, it seems that there may be great potential for development as regards the administrative management of labour law, as the blockchain allows to have information on the employment relationship that is shared, certain, between subjects that dialogue. Therefore, large space can have the blockchain technology in the management of labour market institutions, especially in the perspective of the elimination of intermediation of any third party.

#### The future of work

The technological and scientific development of the last few years has laid the foundations for a real digital technological revolution, whose repercussions are not slow to show up on the production systems and on the occupational profiles of the companies. Which are forced between conflicting forces, such as, on the one hand, the vital

Thus, among the technical works it is possible to include the blockchain information security analyst, the blockchain data scientist, the blockchain developer. Likewise, among the jobs not strictly related to the technical use of the blockchain there are the marketing blockchain specialist, the blockchain project manager, the technical recruiter. It is therefore a market still in the process of being formed and defined, in which the possession of the required digital and technological skills will be the determining condition for the possibility of accessing or not accessing the job opportunities linked to the development of the blockchain.

P. Ichino, Le conseguenze dell'innovazione tecnologica sul diritto del lavoro, in Rivista italiana di diritto del lavoro, 2017, 4, 1, 525.

In terms of consolidation of an alternative circuit of the encounter between supply and demand for work see P. Tullini, *Economia digitale e lavoro non standard*, in *Labour Law Issues*, 2016, 2, 2, 5.

modernization of technological structures and the necessary updating of the professional skills of the workers employed and, on the other, the need to support the greater level of competitiveness introduced by technologies increasingly sophisticated digital media.

Recent digital innovations pose several problems not only in terms of managing the employment dynamics linked to the transformation of the production process, but also and above all in terms of continuous training of the worker<sup>27</sup>. On closer inspection, even today there is not a full awareness of the evolution of digital technology and its effects on work and employment, especially in terms of skills and professional skills necessary to support and contribute to the change in production processes.

The market therefore may begin to turn to blockchain technology as a tool for the "humanization" of work, which evolves and integrates with the Industry 4.0 digital manufacturing program, given that the blockchain lends itself to becoming the reference paradigm for production models and the business models of the various sectors, especially where innovative solutions are needed that can reduce inefficiencies and protect the environmental sustainability of production.

In conclusion, due to its complexity, the theme allows to glimpse the new potential that blockchain technology allows businesses to develop. The real challenge, in the current historical, economic and cultural context, however, is to understand how it will change the role of intermediate bodies and the employment relationship and where, and with what character, its applications will find full manifestation.

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