

## ZANJIRLI UZATMALAR

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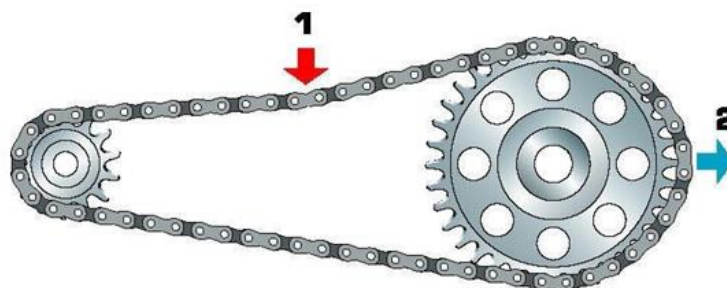
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**Tayanch soʻzlar:** yulduzcha, zanjir, vtulkali, vtulka-rolikli, rolikli va tishli zanjir, plastinka, tarmoqdagi kuchlar, taranglik kuchi, salqilik.

*Umumiy maʼlumotlar*

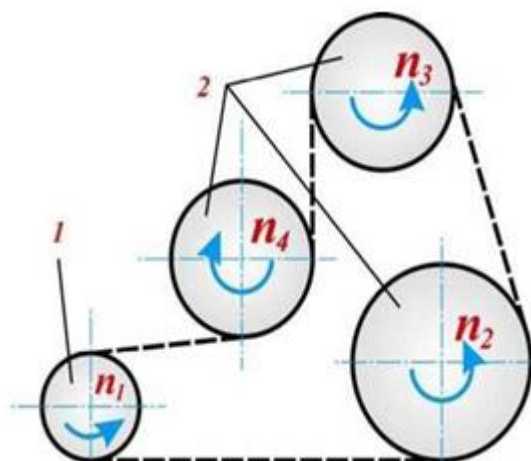
Yetakchi va yetaklanuvchi ikkita yulduzchalar hamda ularga kiydirilgan zanjirdan iborat boʻlgan mexanizm zanjirli uzatma deyiladi. (1 - rasm).



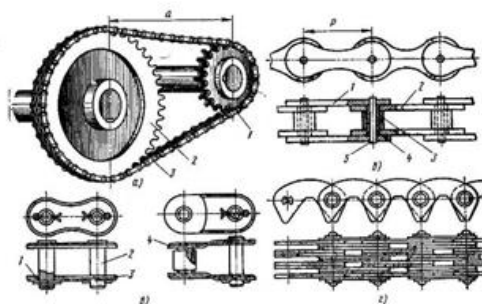
1-rasm. Zanjirli uzatma

Uzatma tarkibida bulardan tashqari vallar, podshipniklar, taranglovchi moslamalar, moylovchi qurilmalar va ximoyalash toʻsiqlari boʻladi.

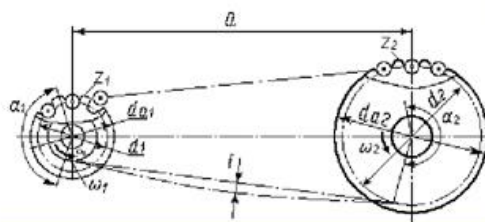
Bir vaqtning oʻzida bir necha staklanuvchi yulduzchalarni ham qoʻllash mumkin.



2-rasm . Harakatni bir necha etaklanuvchi vallarga zanjirli uzatma orqali taksimlash



3- rasm. Zanjirlarining turlari



4 – rasm. Zanjirli uzatma.

Mashinasozlikda zanjirli uzatmalarining xarakterga keltiruvchi mexanizm- yuritma, yuk tashish va tortish uchun mo'ljalangan turlari ishlatiladi. Yuk tashish uchun ishlatiladigan zanjirlar xarakter tezligi katta bo'lmagan yuk ko'taruvchi mexanizmlarda yukni osib qo'yish va uni ko'tarib-tushirish uchun xizmat qiladi. Yuk tortish uchun ishlatiladigan zanjirlar elevator, konveyer va eskalator kabi mexanizmlarda ishlatiladi. Bunday uzatmalar, zanjirning turiga qarab: vtulkali, vtulka-rolikli (3 va 4 -rasm), tishli (3 va 5 -rasm); zanjirlarning soniga qarab: bir qatorli va bir necha qatorli xillarga bo'linadi. Bundan tashqari, bu uzatmalar ochiq yoki yopiq (maxsus qobig' ichiga olingan) bo'lishi mumkin [1].

Afzalliklari:

a) xarakterni tishli uzatmalarga nisbatan uzoq masofaga uzata oladi (vallar orasidagi masofa 8 metrgacha yetadi);  $a \leq 8 \text{ m}$

b) foydali ish koeffitsienti etarli darajada yuqori ( $\eta$  q 0,96...0,98);

v) sirpanish xodisasi ro'y bermasligi va shu sababli uzatish sonining o'zgarmasligi.

g) Xarakterni bir necha etaklanuvchi yulduzchalarga uzatish imkoniyati borligi zanjirni almashtirish yengil.

d) val va tayanchlariga tushadigan kuchlarning nisbatan kichikligi.

Kamchiliklari:

a) zanjirlar va yulduzchalarning tayyorlashni murakkabligi va tannarxini yuqoriligi;

b) ishlaganda nazorat talab qilinishi;

v) yig'ishda yuqori aniqlik talab qilishi;

g) zanjir elementlarining eyilishi zvenolar uzunligining ortishiga va qo'shimcha dinamik kuchlarning paydo bo'lishiga sabab bo'ladi, bu o'z navbatida uzatmaning notekis ishlashiga olib keladi.

d) shovqin chiqishi

Xozirgi vaqtda mashina va mexanizm yuritmalarida ishlatiladigan zanjirlarning hamma o'lchamlari standartlashtirilgan. Vtulka-rolikli zanjir (5 –rasm ) tashqi zveno 5 -ga presslab o'rnatilgan valik 1 ichki zveno 4 -ga presslab joylashtirilgan vtulka 2 va vtulkaning atrofida bemalol aylanadigan qilib kiydirilgan rolik 3 dan tuzilgan. Zanjir yulduzchaga roliklar vositasida ilashadi. Rolikning yulduzcha tishiga tekanda aylanib ketishi sirpanib ishqalanishni dumalab ishqalanishiga aylantiradi. Bu tishlarning eyilishini susay-tiradi va uzatma ishlashini yaxshilaydi. Katta tezlik va yuklanish bilan ishlaydigan uzatmalarda ko'p qatorli zanjirlar ishlatiladi [2].

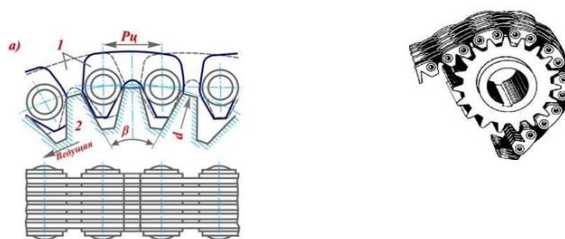
Vtulkali zanjirlarning vtulka-rolikli zanjirdan farqi shuki, unda vtulka ustida kiydirilgan rolik 5 bo'lmaydi. Buning natijasida zanjirning og'irligi va tannarxi kamayadi. Biroq vtulkali zanjirning hamda u bilan ilashishda bo'lgan yulduzchalarning tishlari nisbatan tez eyiladi. Shuning uchun ular kam yuklanishli va xarakat tezligi nisbatan kichik uzatmalarda foydalanish tavsiya etiladi.

Tishli zanjirlar ikki uchida tishga o'xshash chiqiqlari bo'lgan plastinkalar yig'indisidan iborat bo'lib, yulduzcha tishlari shu chiqiqlar orasida joylashib ilashma xosil qiladi (6 – rasm ).

Bu zanjirlar nisbatan ishonchli va mustahkam bo'lib, katta tezlik va quvvat uzatmalarda ishlatiladi. Lekin tishli zanjirlarning nisbatan og'irligi va tayyorlashning qiyinligi tufayli kamroq ishlatiladi.



4– rasm. Vtulka- rolikli zanjir;



5– rasm. Tishli zanjir.

Uzatmaning quvvati:

$$P = F_t \cdot V / 1000, \text{ kVt. Tezligi:}$$

$$V = z \cdot t \cdot n / 60 \cdot 1000 \text{ m / s ,}$$

bu erda:  $z$  - yulduzcha tishlarining soni;  $t$  - zanjirlarning qadami;

$n$  - yulduzchanning aylanish soni,  $\text{min-1}$ ;  $F_t$  - aylanma kuch, KN.

Uzatmaning uzatish soni:

$$U = \omega_1 / \omega_2 = n_1 / n_2 = z_2 / z_1.$$

Uzatmada  $P \leq 100 \text{ kVt}$ ,  $V \leq 15 \text{ m / s}$ ,  $n \leq 500 \text{ min-1}$ ,  $u \leq 7$  tavsiya etiladi. O'rtacha tezlikdagi rolikli uzatma uchun yulduzchalar uchun-  $z_1 \text{ min} = 17 \dots 19$ ;  $z_2 \text{ max} = 100 \dots 120$ .

Yulduzchalarning tuzilishi tishli g'ildiraklarning tuzilishiga ko'p jihatdan o'xshash. Uning bo'lish diametri  $u$  bilan ilashishdagi zanjir valiklarining markazidan o'tadi va quyidagicha aniqlanadi [3]:

$$d = t / \sin (\pi / z).$$

Yulduzchalar markazlararo masofasi quyidagicha aniqlanadi:

$$a \text{ min} = (d_{a1} + d_{a2}) / 2 + (30 \dots 50) \text{ mm},$$

bu erda  $d_{a1}$  va  $d_{a2}$  - yulduzchalarning sirtqi diametrlari.

Zanjirning chidamliligi yetarli darajada bo'lishini ta'minlash maqsadida  $a = (30 \dots 50) t$  mm qilib olish tavsiya etiladi.

Odatda, zanjirning uzunligi qadamlar soni bilan belgilanadi:

$$L_t \approx 2 a / t + (z_1 + z_2) / 2 + ((z_2 - z_1) / 2\pi)^2 (t / a).$$

Aniqlangan  $L_t$  qiymatni butun juft congacha yaxlitlanadi va bunga ko'ra  $a$  qayta aniqlanadi:

Uzatmaning normal ishlashi uchun zanjir ma'lum darajada salqi bo'lishi kerak. Buning uchun  $a$  -ning qiymati taxminan (0,001...0,002)  $a$  ga qadar kamaytiriladi.

Uzatmadagi kuchlar

Zanjirli uzatmalarda quyidagi kuchlar xosil bo'ladi:

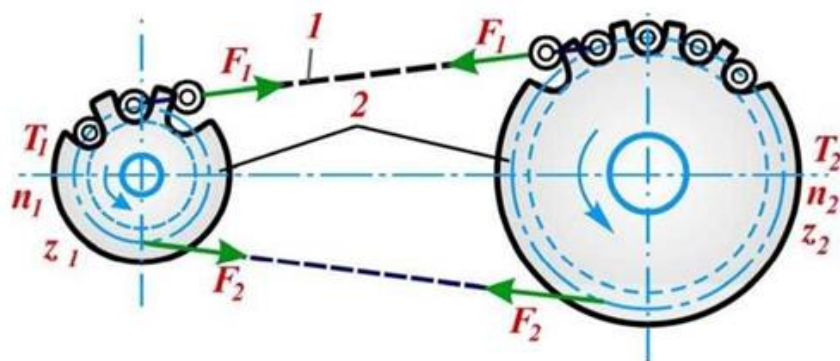
$F_1$  va  $F_2$  -zanjirning yetaklovchi va yetaklanuvchi tarmoqlaridagi kuchlar;  $F_t$

-aylanma kuch;  $F_0$  - dastlabki taranglik kuchi;  $F_v$  - markazdan qochma kuch ta'sirida hosil bo'ladigan kuch.

Kuchlar orasidagi munosabat quyidagicha:

$$F_1 - F_2 = F_t, F_v = m \cdot V^2, F_0 = K_f \cdot a \cdot m \cdot g,$$

bu yerda  $a$  –zanjirning salqilik hosil qiladigan qismining uzunligi;  $m$  -bir metr zanjirning massasi kG/m);  $g$  -og'irlik kuchining tezlanishi, m/sek<sup>2</sup>;  $K_f$ - - salqilik koeffitsienti (uzatmaning gorizantal tekislikka nisbatan joylashuviga va  $f$  - zanjirning salqilik qiymatiga bog'liq). Odatda,  $f \approx (0,01 \dots 0,02) a$  tavsiya etiladi.



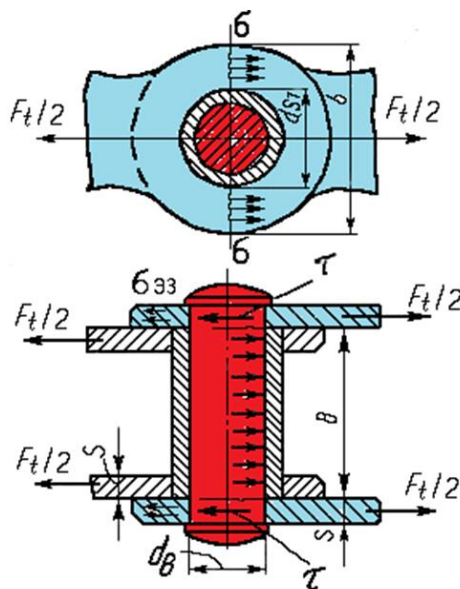
6- rasm. Zanjirli uzatmaga tushadigan kuchlar

Odatda, uzatmaning yaxshi ishlashi uchun  $F_2 = F_0 - F_v > 0$  bo'lishi kerak, ya'ni zanjir elementlarining yeyilish me'yorida bo'lishi uchun  $F_0 > F_v$  shart bajarilishi kerak [4].

Amaliy hisoblarda odatdagi uzatmalar uchun  $F_1 \approx F_t$ ,  $F_2 \approx 0$  qilib olish mumkin.

Zanjirdagi kuchlanishlar.

Zanjir elementlarida asosan quyidagi kuchlanishlar hosil bo'ladi (7- rasm):



7 – rasm. Zanjirdagi kuchlanishlar.

a) ichki plastinkalarning vtulka o'rnatiladigan qismidagi cho'zuvchi kuchlanish:  $\sigma$

$$\sigma = F_t$$

2(b  $\cdot$  d VT )S

$$\sigma = \frac{F_t}{2(b \cdot d_{VT})S}$$

b) sirtqi plastinkalarning valik o'rnatiladigan qismidagi ezuvchi

Bu kuchlanishlar zanjirning standart o'lchamlarini belgilashda e'tiborga olingan.

Mashinasozlikda ko'p ishlatiladigan vtulka rolikli zanjirlar uchun yuqorida keltirilgan kuchlanishdan sharnirda hosil bo'ladigan bosim eng asosiysidir. Chunki zanjirning ishlash muddati uning sharnirlarining ishlash muddati bilan belgilanadi. Shuning uchun

zanjir sharnirlarining yeyilishga chidamliligini aniqlanadi, bunda quyidagi shart bajarilishi kerak [5]:

$$q = Ft / ( B \circ dv ) \leq [ q ],$$

bu erda  $q$  - sharnirdagi (valik bilan vtulka o'rtasidagi) bosim;

$Ft$  - aylanma kuch, N;  $dv$  –valikning diametri;  $V$  - zanjirning eni;

$[ q ]$  - joiz bosim, uning qiymati zanjirning qadamiga va yetakchi yulduzchanning aylanish soniga ko'ra jadvalda beriladi.

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## EMERGING TECHNOLOGIES IN SUPPLY CHAIN MANAGEMENT TA'MINOT ZANJIRINI BOSHQARISHDA RIVOJLANAYOTGAN TEXNOLOGIYALAR

**Muhammadyoqub Qundusovich**

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**Abstract:** *Logistics has undergone a transformative change in the last ten years, thanks to innovative technologies such as artificial intelligence, neural networks, and machine learning. It’s an industry shift drawn from the demand to increase delivery times, make products cheaper, and improve the way companies interact with the environment.*



The largest problems faced by supply chain managers, however, have remained consistent over the last few decades. Supply chains face an array of local and global public policy challenges such as:

- Population and wealth growth in rural areas;
- Freight movement restrictions in urban environments;
- Sustainability, carbon footprints, and emissions regulations;
- Trade wars and border battles; and
- Economic restructuring.

But even though professionals already know all about these industry pitfalls, it has only recently become common to try managing so many of these challenges at the same time. This fact, along with increasing consumer demands, could define the new normal for supply management, says Shay Scott, executive director of the Global Supply Chain Institute at the University of Tennessee, Knoxville’s, Haslam College of Business.

Top trends in supply chain technology.

How to cope with the new normal? Innovations, like end-to-end supply chain automation and multi-dimensional systems, help organizations address contemporary problems with modern strategies. Below, we’ll outline emerging technologies in supply

chain management, how they're incorporated into existing businesses, and the extent to which they will affect supply chains in the future [1-5].



Tens of thousands of Chicago-area residents participated in the development of the GO TO 2040 plan through in-person community meetings and interactive online tools. Photo courtesy of the Chicago Metropolitan Agency for Planning

GO TO 2040

Metropolitan Chicago, Illinois

This seven-county regional plan for growth and economic development engages a wide variety of partners and links local planning efforts to a broad regional vision through tools and technical assistance.

Film Reel Graphic

Innovative supply chain technology tools

Staying competitive in supply chain management requires adopting the most advanced technology. Mary Long, director of the Supply Chain Forum, says, "It takes an understanding in knowing what to go after to create supply chain efficiencies." Enterprises such as the Kraft Heinz Company (the third-largest food and beverage company in North America) and McCormick & Co. (Baltimore-based maker of spices and seasonings) invest in technology to create efficient, sustainable, and socially responsible supply chains. Both companies are designated as a "Shipper of Choice" by FreightWaves, an award that ranks the "industry's most innovative and/or disruptive companies."

Here are some of the emerging technological trends, tools, and innovations used in supply chain management:

**Big data.** Massive amounts of data are generated every single day. Each minute, 4.5 million searches are entered in Google, 18.1 million text messages are delivered, and 188 million emails are sent. Mobile devices such as wearables, smartphones, and tablets generate a significant amount of the total data usage each day. With so much information at our disposal, it takes complex computing techniques to gather, sort, clean, and analyze



such large data sets. Data science and analytics allow companies to use data to gain valuable insights and revolutionize supply chain management. Big data brings value and assistance to the following areas in supply chain management [6-10]:

- Quality control;
- Cash flow;
- Real-time deployment;
- Warehouse efficiency;
- Weather patterns;
- Predictive strategies; and
- Inventory, supply, and demand.

Artificial intelligence and machine learning. AI and machine learning create fully- or semi-automated processes and procedures for supply chain optimization. Optimization improves forecasting, planning, implementation, and maintenance in logistics by using AI and machine learning to emulate human performance and knowledge. AI and machine learning boost the end-to-end supply chain by:

- Tightening data security;
- Applying predictive modeling to third-party logistics;
- Providing full supply chain visibility to improve management of key performance indicators (KPI);
- Automating inventory management, shipping transactions, and delivery routing; and
- Improving customer service.

Internet of things (IoT). The IoT — the streamlined connection across various devices — increases visibility and connectivity, while also reducing costs. Wearables and mobile devices like Apple Watches, Fitbits, and smartphones, are especially useful in warehouse settings. Wearables, in particular, provide solutions that lead to having a “touchless” supply chain: the total elimination of the labor-intensive selection of items from inventory to fulfill a customer order, also known as “picking.” Other IoTs allow warehouse and logistics managers to securely track inventory and monitor equipment. Other benefits include [11-15]:

- Improved asset utilization;
- Better customer service;
- Streamlined inventory and supply availability; and
- Safer and more reliable work environments.

5Gs. According to Qualcomm, 5G is foundational to further innovation, which is certainly the case when it comes to supply chain management. Gaining real-time data is difficult when suppliers lack connectivity. Supply chain visibility becomes spotty without 5G. And third-party logistics is made possible through the use of 5G because it elevates mobile networks through multi-Gbps peak rates, ultra-low latency, and massive data capacity. High-level performance, increased efficiency, and new user experiences become

available when 5G interconnects people, machines, objects, and devices. 5G further offers the power to:

- Extract larger amounts of data concerning location, temperature, pressure, and other information that is critical in the end-to-end supply chain;
- Ensure uniformity of information sharing with all stakeholders;
- Resolve issues that would otherwise be aggravated with time delays; and
- Understand exactly where raw materials come from.

The Cloud. At any point during the end-to-end supply chain, companies track materials and products, get real-time updates, and inform customers of the status of an order. This is all made possible with cloud computing. Cloud-based solutions enhance a number of areas such as data storage space, integration, security, and information sharing. Activities and processes are streamlined between multiple devices and an enterprise of software users.

Advanced supply chain management software. Advanced software has disrupted the entire supply chain industry. In order to stay competitive, logistics companies continue to incorporate technology into their supply chain systems. Businesses feel compelled to track the latest technologies on the market because of consumer demands on cost and delivery speed, and the increasing popularity of customer rating metrics. As technology advances, supply chain software becomes more complex, allowing companies to stay ahead of mistakes, make modifications to orders, communicate across various media channels, and automate shipping. G2— a tech marketplace where businesses discover, review, and manage industry technology — lists the following supply chain management software companies

and tools as some of the most popular in the industry: Supply Chain Suites Software	<u>Demand Planning Software</u>	<u>Distribution Software</u>	<u>Inventory Management Software</u>
<a href="#">Logility Voyager Solutions</a> <a href="#">AIMMS Prescriptive Analytics</a> <a href="#">GAINSystems</a> <a href="#">Ramco ERP</a> <a href="#">IBIS Advanced Supply Chain Software</a> <a href="#">OrderEase</a>	<a href="#">Oracle Demantra</a> <a href="#">SAP Integrated Business Planning</a> <a href="#">LivePlan</a> <a href="#">Logility Voyager Solutions</a> <a href="#">Blue Yonder</a> <a href="#">Demand Planning</a> <a href="#">Blue Yonder</a> <a href="#">Inventory Optimization</a>	<a href="#">Verizon Connect</a> <a href="#">Geopointe</a> <a href="#">Spotio</a> <a href="#">Salesforce Maps</a> <a href="#">GPS Insight</a> <a href="#">Workwave</a> <a href="#">Route Manager</a>	<a href="#">DiCentral EDI &amp; Supply Chain</a> <a href="#">Kintone</a> <a href="#">Epicor Prophet 21</a> <a href="#">Webgility</a> <a href="#">Dynamics 365</a> <a href="#">Business Central</a> <a href="#">Fishbowl Inventory</a>

Technologies predicted to impact supply chain management in the future

The future of supply chain management will continue to include any emerging technologies which support efficiency and automation. Here are a few more software trends experts predict are in the pipeline:

- Autonomous mobile robots (AMR). Supply chain giants like Amazon have discussed the use of AMRs in the past, but they haven't been widely adopted across the industry. While warehouse management systems will continue to organize things like scheduling

loading and unloading, AMRs may emerge as a tool to optimize the picking process [16, 17, 18].

- Truck collaboration. Truck manufacturers and shippers are preparing for a recession and would be wise to invest in manufacturing and collaboration software systems. More advanced systems allow for trucking companies to strengthen the way they monitor the market, automate processes, and cut costs.

- Distributed inventory. Current inventory software isn't providing the analysis needed to keep up with distributed inventory, making it harder for companies to keep up with innovative shipping demands. A tool called distributed inventory flow forecasting (DIFF) predicts the flow of materials, enabling businesses to maximize the order fill rate and maintain reduced inventory [19, 20, 21].

- Driverless vehicles and drone delivery: Driverless and drone delivery options provide companies with a solution to a variety of issues. Not only does this lower costs by lowering the amount of human intervention, but it also gives more access to remote and hard-to-reach rural areas. While some have been skeptical about this technology in the past, it may be a positive solution for the future, particularly in light of the worsening shortage in available human drivers.

- 3D printing: 3D printing is a game changer for certain industries. 3D printing can be used to replicate and produce replacement parts for products using metals and plastics. Rather than stocking items in a large warehouse to be shipped all over the world, companies can contract with local 3D printing shops to print and deliver products within a matter of days. The benefits for inventory and space management transfer to the consumer level as well, improving customer satisfaction [22, 23, 24].

- Blockchain. With the exchange of goods across different countries, there is often a lack of transparency. Invoices and shipments can take several months to process, never mind the complexity of greater volume across many organizations. Blockchain has the potential to transform the supply chain industry by providing more traceability and security. Widely popularized by its cryptocurrency ability, the blockchain can also assist companies by managing contracts and agreements, and monitoring financial transactions and products.

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Why the Executive MBA for Global Supply Chain at the University of Tennessee's Haslam College of Business?

There are a number of reasons to choose an Executive MBA for Global Supply Chain at the Haslam College of Business, including its modern, technology-focused curriculum. Haslam offers an industry-centered curriculum, led by expert faculty who are dedicated to the future of supply chain management. The University of Tennessee has been ranked #3 in the Top 25 North American Supply Chain University Graduate Programs by Gartner, and the Global Supply Chain Institute (GSCI) is a preeminent global hub for leading practitioners, academics, and students to learn, network, and connect with scholars and industry experts.

Learn more about the GSCI and Haslam's Executive MBA for Global Supply Chain today.



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