It was the 3 December 2018, Mr Keith Gregor had just arrived at his office located in Mahwah, NJ, in the USA. Keith is the Managing Director of JagRover Operations. He was about to head for a meeting with the commercial team when he received a call from Mr Greg Pawsat. Greg is the Senior Vice President of IT product solutions in SAP. Greg informed Keith that as part of a strategic decision taken by the company, SAP is not going to support any of the previous SAP versions which uses a database other than SAP high-performance analytic appliance (HANA) after 2025. After the conversation, Keith realized that the warehouse management solution which the operations had been using for 6 years will become obsolete by 2025 as the system uses a DB2 database.

During the conversation, Greg also spoke about their upgraded product of warehouse solution known as the extended warehouse management (EWM) which now comes as an embedded system with the S/4 HANA product (SAP Suite for HANA). He claimed the upgraded system to be highly efficient with additional functionalities which the traditional warehouse management system (WMS) lacked. The standard EWM system is also loaded with many analytical tools. He spoke about significant improvements in the planning module of SAP known as the advanced planner and optimizer (APO) in their upgraded S/4 HANA product.

Changing the entire process from the point of view of JagRover will have huge implications. There will be significant changes in the warehouse management and the planning system. The warehouse associates have been using the inbound and outbound operational transactions for many years which will now become obsolete. This will also have impact on the various dashboards for reporting purposes used by the warehouse associates and the inventory management teams. Overall, the process will involve huge cost to the company and Keith was under the dilemma whether it would be a good decision to invest on S/4 HANA or to think of some other alternative.
About the Company

JagRover is a British multinational automotive company with its headquarters in Leicester, UK, and is a subsidiary of an Indian automotive company. The principle activity of the company is to design, develop, manufacture and sell luxury and sports utility vehicles. The history of the parent companies goes back to the 1930s and 1940s, respectively, for each parent company. The two parent companies came together in 1968 as part of a conglomerate, but later again became independent and subsidiaries of two large automobile companies. One of the parent companies between the two acquired the entire company in 2000. JagRover has been a subsidiary of an Indian automotive company since they acquired it from the parent company again in 2008. The operations of the parent companies merged and was later renamed as JagRover Automotive PLC on 1 January 2013.

The company has been known for design and technology innovations in the automotive sector worldwide. Though the manufacturing plants are mostly located in the UK, JagRover has an incredible global reach. More than 80 per cent of the vehicles are currently sold outside the country through a comprehensive distribution network they have a presence in more than 178 markets. The company has 10 manufacturing and assembly plants across the globe which are responsible for the assembly of the wide range of products of the company. The company has 12 warehouses globally for JagRover, including a global master facility in Milwaukee, WI, USA. These warehouses supply the spare parts to the various plants of the company. The ERP system used for the warehouse operations is an SAP WMS.

The Current IT Infrastructure

The SAP WMS is the backbone for the JagRover operations. The warehouse management framework interacts with other SAP standard modules such as—SAP MM (materials management), SAP SD (sales and distribution) and SAP APO. The framework is hosted on a DB2 database. The WMS is built on SAP ECC version 6.0 (Table 1). The system supports several operational processes in the warehouse (Figure 1). Some customizations have been done in the standard SAP WM module considering the operational best practices. JagRover’s warehouses are radio frequency (RF) enabled via handheld devices such as RF guns which is integrated with the standard solution. Further in some locations, operations use voice devices to pick, for shipping along with a conveyor system for better operational efficiency. For any customizations, the system goes through a development phase where custom logic is written using SAP introduced programming language called Advanced Business Application Programming (ABAP). The IT landscape is designed in such a way that, SAP WMS connects with several other client systems for data exchange and is routed through a middleware (Table 2).

| Year       | SAP Release                          |
|------------|--------------------------------------|
| 1973       | SAP R/1                               |
| 1980       | SAP R/2                               |
| 1992       | SAP R/3                               |
| 1998       | SAP R/3 Release 4.0B                  |
| 1999       | SAP R/3 Release 4.5B                  |
| 1999       | SAP R/3 Release 4.6B                  |
| 2001       | SAP R/3 Release 4.6C                  |
| 2003       | SAP R/3 Enterprise Release 4.70       |
| 2004       | SAP ECC 5.0 ERP (mySAP ERP 2004)      |
| 2005       | SAP ECC 6.0 ERP (mySAP ERP 2005)      |
| 2009       | SAP Business Suite 7 (ERP 6, Enhancement Package 4) |
| 2011       | SAP HANA (In-memory Platform)         |
| 2012       | SAP Business Warehouse Powered by SAP HANA |
| 2013       | SAP Business Suite Powered by SAP HANA |
| 2014       | SAP Simple Finance Powered by SAP HANA |
| 2015       | SAP S/4 HANA                          |

Source: The author.

| Services Offered by SAP in Current WMS |
|----------------------------------------|
| Warehousing                             |
| Inbound receiving                      | Receiving materials from supplier and storing it in warehouse |
| Outbound shipping                      | Shipping materials to customers |
| Packaging                               | Packaging materials by boxing and labelling them |
| Kitting                                | Build kit inside warehouse to fulfill an existing customer order or stock requirement |
| Cross-docking                          | Use warehouse space to receive materials from vendors, but do not store them. Further, operations can ship from the designated cross-dock space |
| Replenishing production plants          | In case the warehouse supplies materials to plants |
| Quality check                          | Inspection done before the material is stored in the warehouse |

Inventory management

| Planning                               | Service parts planning |
| Optimization                           | Optimization of resources and warehouse space |
| Replenishment                          | Replenishment of materials in warehouse |
| Supplier relationship management       | Building supplier relationship with the entire supply chain for the clients |
| Inventory accuracy control (IAC)       | Inventory auditing |

(Table 2 Continued)
Customer services
Help desk Level 1 support to the clients

Logistics planning and engineering
Engineering Designing warehouse layout and storage

Source: The author.

Figure 1. Inbound Process: Outbound Process
Source: The author.

Note: If there are sales orders in the system for which there is no stock to meet the customer demand, then the picker has to wait for the stock allocation job to complete. The stock allocation job does a backtracking of the materials of the sales order from the inbound delivery, purchase order, and the advanced shipment notification and allocates the stock in the system for the sales order and if it cannot fulfill the order, an ETA is provided.

The current system also has a planning tool known as spare parts planning (SPP) which is built on top of SAP APO with few customizations. SPP is a forecasting tool (Figure 2) built on few in-built models which standard SAP provides. The order data from SAP WMS is transferred to SPP using core interface (CIF). Once the data is available in SPP the demand for the materials are forecasted using the models. After the calculation of economic order quantity (EOQ) and safety stock, some jobs known as the distribution resource planning (DRP) calculates the time-phased inventory requirements and sends the procurement requests to SAP WMS Inventory management via CIF again. The procurement requests before converting into purchase requisitions in SAP goes through a procurement approval process and finally the purchase requisitions are sent to appropriate vendors. SPP also runs some jobs known as the pull and push deployments in order to procure materials from other parent warehouses before releasing the procurement requests to vendors. The SPP system uses DB2 database which is a different one from the SAP WMS one. Also, there is another database known as the MaxDB database where the live cache is stored. There are regular syncs between the two databases to maintain the data integrity.

To keep pace with the rapidly changing technology, SAP has introduced their new standard product to support warehouse management known as EWM. The latest EWM version is embedded with SAP S/4 HANA (SAP version 7.5) which uses the HANA database. HANA claims to run ERP applications 2–3 times faster than any other traditional relational database. SAP’s application server is currently compatible with any other databases such as Oracle or DB2. In 2011, SAP launched their in-memory database HANA which is a column-oriented relational database management system. This combines the on-line transaction processing (OLTP) and on-line analytical processing (OLAP) into a single database eliminating bottlenecks and offering very high performance. Historically, first came SAP HANA in the year 2011 followed by Suite on HANA, followed by SAP simple finance and finally to SAP S/4 HANA (Table 4). SAP is gradually upgrading and moving to the newer technologies and at the same time they want their clients to keep up the same pace with their products. SAP has announced that by 2025 they are not going to support systems which are not using the HANA database. Basically, this means that they will not support any SAP releases including ECC 6.0 and prior to that after 2025 (Table 1).

Challenges to Keith

When driving back from office that night, Keith’s thoughts were occupied with the discussion he had with Greg. This reminded him of the various investment decision case discussions from his MBA days. He tried to think through the various alternatives. Renewing the contract for the same solution is not an option for him because eventually SAP will not support the current solution. So, he should either upgrade the system to S/4 HANA or implement a comparatively low-cost ERP solution like JDA WMS (RedPrairie). He did not consider Oracle or any other high cost ERP solution because their current system has many custom solutions such as cross-dock, kitting and dynamic cycle counting which will involve huge investment to implement them in a high-cost ERP package solution. In that sense, the custom solutions are already available in EWM module of S/4 HANA or can be implemented at a low investment cost in JDA WMS (RedPrairie). He then tried to think through the various decision criteria on which the options should be measured against and narrows down to three major criteria, namely cost involved in the migration, operational efficiency and advanced reporting, and analytic tools which is of paramount importance for the warehouse supervisors.

Figure 2. Stock Allocation Process
Source: The author.
He realized that the current solution being on SAP there will be less training cost if they migrate to S/4 HANA. But he was not sure about the potential of S/4 HANA in terms of its analytical capabilities. On the other hand, RedPrairie is compatible with Oracle database and Keith was aware that it could run ERP applications as efficient as the current relational database (DB2). There are 12 warehouses globally for JagRover which have almost same volume, so he decided to take anyone of the warehouse data randomly and do the study. He took the warehouse data of the facility in Milwaukee, WI, USA, and started with his analysis by speaking with John Roe who is the warehouse supervisor of the same warehouse.

About JagRover Facility in Milwaukee, WI, USA

SAP operates 12 facilities globally for JagRover, including a global master facility in Milwaukee, WI. The warehouse has 450 warehouse associates and the facility is spread across 1.4 million square feet. Out of the 450 warehouse associates, 300 are SAP users who work on the daily operations. Their SAP access is very limited and restricted to the particular job they are entitled to. They work in three different shifts and close to 50 SAP user IDs are shared across shifts. The total revenue per year from the 30,000 outbound lines of the warehouse is more than 45 million USD.

Keith had a discussion with the warehouse supervisor John Roe from Milwaukee and could collect some useful information and data which should help him in his analysis. He got to understand the inbound and the outbound flow (Figure 1). On asked by Keith, whether he feels any process needs improvement for increasing operational efficiency, John spoke about two points. First, he talked about the order fill rate which is nothing, but the percentage of order fulfilled with stock readily available. He said currently the order fill rate is 92 per cent for the warehouse. The SPP job for forecasting, which runs for stock allocation and creates purchase requisitions in the system (Figure 2), on an average run for 12 hours due to which there are less outbound lines fulfilled and back orders get created in the system. This impacts the overall revenue (Table 3) generated from the facility. Another concern which was raised by John, which customers often complain to him, was regarding the data analytics and visualization tools. Currently, there are no proper monitors or dashboards for the managers which serves the purpose of a decision support system. The reports are mainly built on ABAP which has interactive features but visually not very attractive and takes long time to build and deploy. John had also talked about applications which shows runtime tracking of their orders and gave the example of Amazon and Flipkart. During the conversation, he also got to know that the company considers 10 per cent as the minimum acceptable rate of return for screening investment proposals.

| Functionality                                      | WM | EWM |
|---------------------------------------------------|----|-----|
| Manage Stock and Storage Location                 | ☒  | ☒   |
| Bin Management                                    | ☒  | ☒   |
| Placement Strategies                              | ☒  | ☒   |
| Removal Strategies                                | ☒  | ☒   |
| Pick Logic                                        | ☒  | ☒   |
| Replenishment                                    | ☒  | ☒   |
| Standard Mobile RF Technology                     | ☒  | ☒   |
| Handling / Storage Unit Management                | ☒  | ☒   |
| Yard Management                                   | ☒  | ☒   |
| Enhanced configurable RF Technology               | ☒  | ☒   |
| Task and Resource Management                      | ☒  | ☒   |
| Expected Goods Receipt                            | ☒  | ☒   |
| Value Added Services                              | ☒  | ☒   |
| Opportunistic Cross-Docking                       | ☒  | ☒   |
| Dynamic Cycle Counting                            | ☒  | ☒   |
| Unloading of Transport Units                      | ☒  | ☒   |
| Deconsolidation                                   | ☒  | ☒   |
| Slotting Re-arrangement                           | ☒  | ☒   |
| Labor Management                                  | ☒  | ☒   |

Source: The author.

Next Steps

After getting all the data from the facility in Milwaukee, Keith felt well equipped to start his analysis. He has to evaluate the two options based on the financial aspect and the analytical aspect and finally he should arrive at a better investment choice between them. He also knows that the company considers 10 per cent as the minimum acceptable rate of return for screening investment proposals and the rate of changes of cash flows is constant. HANA being a column-store in-memory databasing architecture fetches data 2–3 times faster than any other relational database. Therefore, the DRP jobs can run much faster and hence there will be an improvement in the order fill rate. So, he decides to target the order fill rate and tries to find out in which option he will have a better cash inflow.

Questions

1. From financial perspective, which is a better investment choice for Keith—SAP HANA or RedPrairie? (Refer Table 5, 6, 7 and 8).
2. Considering the IT infrastructure, which is a better choice in terms of technology solution and database design—SAP HANA or RedPrairie?
Table 4. Database Comparisons

| Feature                          | Sap Hana | Oracle Exadata | DB2 |
|----------------------------------|----------|----------------|-----|
| 100% in-memory database          | ☑        | ☑              | ☑   |
| Holds 100s of terabytes in memory| ☑        | ☑              | ☑   |
| Simple, all-in-one platform      | ☑        | ☑              | ☑   |
| Choice of hardware providers     | ☑        | ☑              | ☑   |
| Unified app and database server  | ☑        | ☑              | ☑   |

Source: The author.

Note: Due to the above features, SAP HANA claims to be 2–3 times faster than any other relational database.

Table 5. JagRover Warehouse Data

| Parameter                                      | Value          |
|------------------------------------------------|----------------|
| Average outbound lines (sale orders) per day   | 30,000         |
| Number of warehouse associates                 | 450            |
| Number of SAP users in warehouse               | 300            |
| Total SAP User IDs used                        | 50             |
| Average revenue per line in USD                | 5              |
| Number of hours the stock allocation job runs in SPP currently | 12 |
| Operating expense in million USD (including salaries and other operating cost) (considering 35,000 USD as yearly salary of 450 warehouse associates + additional operating expenses) | 17 |
| Number of days in year the warehouse operates excluding Sundays and 10 public holidays | 303 |
| Order fill rate (in %)                         | 92             |
| Total number of back orders created in system per day | 2,400 |
| Total revenue from the 30,000 lines in USD     | 30,000 × 303 × 5 = 45,450,000 |

Source: The author.

Note: Line = Sale orders.

Table 6. S/4 HANA Migration and Support Cost

| Migration Cost | Remarks |
|----------------|---------|
| Total modules  | 8       | Warehouse management (WM), materials management or inventory management (MM or IM), sales and distribution (SD), finance and controlling (FICO), ABAP, BASIS, process integration (PI), database administrator. |
| Total resources| 1,457,280| Considering 22 working days for 8 hours billing period. |
| Total resource cost in USD for 1 year          | 1,457,280 |
| Software license cost (perpetual) in USD       | 6,912 |
| Amount in USD                                    | 1,267,200 |
| Additional mark-up for resource cost in USD during migration period | 190,080 |
| Hardware cost (in USD)                          | 49,770 |
| Total cost for 6 months migration period (in USD) | 17,20,190 |

Support Cost

| Total modules | 9       | WM, MM or IM, SD, FICO, ABAP, BASIS, PI, database administrator, Level 1 (L1) support. |
| Total resources| 12      | 2 WM, 1 MM, 1 SD, 1 FICO, 2 ABAP, 2 BASIS, 1 PI, 1 DBA, 1 L1 support |
| Total hours per month | 2,112 | Considering 22 working days for 8 hours billing. |
| Total hours for 1 year | 25,344 |
| Amount in USD | 1,267,200 | Considering 50 USD per hour billing rate. |
| Additional mark-up for resource cost in USD during support period | 190,080 |
| Software license cost (perpetual) in USD | 6,912 |
| Overall cost for 12 expert licenses = 38,400 USD. Considering 18% to be the yearly cost = 6,912 USD |

(Table 6 Continued)
Migration Cost

| Software license cost (perpetual) in USD | 15,300 | Overall license price of 50 restrained user = 85,000 USD. 18% of yearly cost = 15,300 USD |
|----------------------------------------|--------|----------------------------------------------------------------------------------|
| Total yearly cost (in USD)             | 14,79,492 |                                                                                   |

Source: The author.

Table 7. JDA WMS—RedPrairie Migration and Support Cost

Migration Cost

| Total resources | 26 | 7 business analyst, 15 developers, 2 integration specialist, 2 DBA |
|----------------|----|------------------------------------------------------------------|
| Total hours per month | 4,576 | Considering 22 working days for 8 hours billing |
| Total hours for 6 months | 27,456 | |
| Amount in USD | 1,372,800 | Considering 50 USD per hour billing rate |
| Additional mark-up for resource cost in USD during migration period | 205,920 | 15% of resource cost |
| Total resource cost in USD | 1,578,720 | |
| Software license cost (perpetual) in USD | 30,000 | 2,500 USD per facility basis. The cost is calculated for 12 facilities |
| Hardware cost (in USD) | 40,000 | |
| Total cost for 6 months migration period (in USD) | 1,618,720 | |

Support Cost

| Total resources | 10 | 3 business analysts, 4 developers, 1 integration specialist, 1 DBA, 1 L1 support |
|----------------|----|----------------------------------------------------------------------------------|
| Total hours per month | 1,760 | Considering 22 working days for 8 hours billing |
| Total hours for 1 year | 21,120 | |
| Amount in USD | 1,056,000 | Considering 50 USD per hour billing rate |
| Additional mark-up for resource cost in USD during support period | 158,400 | 15% of resource cost |
| Total resource cost in USD for 1 year | 1,214,400 | |

(Table 7 Continued)

Case JagRover—Solution

After getting all the data from the facility in Milwaukee, Keith felt well equipped to start his analysis. He has to evaluate the two options, namely migrating to S/4 HANA or implementing a comparatively low-cost ERP solution JDA WMS (RedPrairie) based on the financial aspect and the analytical aspect and finally he should arrive at a better investment choice between them. He also knows that the company considers 10 per cent as the minimum acceptable rate of return for screening investment proposals. HANA being a column-store in-memory databasing architecture fetches data 2–3 times faster than any other relational database. Therefore, the DRP jobs can run much faster and hence, there will be an improvement in the order fill rate. So, he decides to target the order fill rate and tries to find out in which option he will have a better cash inflow.

Financial Section

SAP S/4 HANA

Migration Cost

| Total number of resources | 26 | |
| Number of working hours per month (considering 8 hours a day and 22 working days a month) | 4,576 | |
| Total number of working hours during the migration period | 27,456 | |
| Resource cost in USD (considering 50 USD per hour billing rate) | 1,372,800 | |
| The mark-up for resource cost in USD during the migration period (15%) | 205,920 | |
| Section | Details |
|---------|---------|
| **Total resource cost in USD** | 1,578,720 |
| **Software license cost (perpetual) in USD** | 91,700 |
| **(26 expert licenses for 3,200 USD + 5 restrained licenses for 1,700 USD)** |
| **Hardware cost in USD** | 49,770 |
| **Total cost for the migration in USD** | **1,720,190** |

**Yearly Support Cost**

| Description | Value |
|-------------|-------|
| Total number of resources | 12 |
| Number of working hours per month (considering 8 hours a day and 22 working days a month) | 2,112 |
| Total number of working hours during the support period | 25,344 |
| Resource cost in USD (considering 50 USD per hour billing rate) | 1,267,200 |
| The mark-up for resource cost in USD during support period | 190,080 |
| Total resource cost in USD | 1,457,280 |
| Software license cost (perpetual) in USD | 22,212 |
| **Total yearly cost in USD** | **1,479,492** |

**JDA WMS—RedPrairie**

**Migration Cost**

| Description | Value |
|-------------|-------|
| Total number of resources | 26 |
| Number of working hours per month (considering 8 hours a day and 22 working days a month) | 4,576 |
| Total number of working hours during the migration period | 27,456 |
| Resource cost in USD (considering 50 USD per hour billing rate) | 1,372,800 |
| The mark-up for resource cost in USD during the migration period (15%) | 205,920 |
| Total resource cost in USD | 1,578,720 |
| Software license cost (perpetual) in USD (2,500 USD for one facility. It is calculated considering 12 facilities) | 30,000 |
| Hardware cost in USD | 40,000 |
| The total cost of migration in USD | **1,648,720** |

**Support Cost**

| Description | Value |
|-------------|-------|
| Total number of resources | 10 |
| Number of working hours per month (considering 8 hours a day and 22 working days a month) | 1,760 |
| Total number of working hours during the support period | 21,120 |
| Resource cost in USD (considering 50 USD per hour billing rate) | 1,056,000 |
| The mark-up for resource cost in USD during support period | 158,400 |
| **Total resource cost in USD** | **1,214,400** |
| Software license cost (perpetual) in USD (considering 18% yearly cost for one warehouse) | 450 |
| **Total yearly cost in USD** | **1,214,850** |

**Profit Before Depreciation and Taxes in Case of SAP S/4 HANA Per Year**

| Description | Value |
|-------------|-------|
| Total outbound lines per day | 30,000 |
| Order fill rate (SAP standard tables calculate the order fill rate which is equal to 92%) | 92% |
| Back order lines created in the system per day | 2,400 |
| Total number of hours the DRP job (stock allocation) runs | 12 |
| DRP job (stock allocation) is expected to run in HANA (in hours) (considering the fact that HANA will increase system performance to 2–3 times) | 4 |
| **The number of lines fulfilled by the current system in:** | |
| 12 hours | 27,600 |
| 1 hour | 2,300 |

If there is an efficiency increase of 3 times, then the number of lines fulfilled by SAP S/4 HANA in:

| Description | Value |
|-------------|-------|
| 1 hour | 6,900 |
| 8 hours (per day operations) | 55,200 |

Therefore, we can say that S/4 HANA can fulfil all 30,000 lines of orders. The order fill rate will be 100 per cent and there will be no back orders created in the system.

The total number of lines which S/4 HANA can increase in a year. (considering ten holidays in a year with 52 Sundays when operation remains closed) | 727,200 |

| Description | Value |
|-------------|-------|
| Total revenue per year (considering each line revenue to be 5 USD) in USD | 3,636,000 |
| Total revenue from 30,000 lines in USD | 45,450,000 |
| Total revenue per year in USD | 49,086,000 |
| Operating expense in USD (considering 35,000 USD as the yearly salary of 450 warehouse associates + additional operating costs) | 17,000,000 |
| IT support cost in USD | 1,479,492 |
| **Profit before depreciation and taxes per year in USD** | **30,606,508** |

**Profit Before Depreciation and Taxes in Case of JDA WMS—RedPrairie Per Year**

DRP job is expected to take the same number of hours to complete in case of RedPrairie. As per the case fact, Oracle will have the same performance as the current system, so we can say that the order fill rate remains 92 per cent.
Total revenue from 30,000 lines (considering each line revenue to be 5 USD and Considering 10 holidays in a year with 52 Sundays when operation remains closed) 45,450,000

Total revenue per year in USD 45,450,000

Operating expense in USD (including salaries and other operating cost) (considering 35,000 USD as the yearly salary of 450 warehouse associates + additional operating expenses) 17,000,000

IT support cost in USD 1,214,850

Profit before depreciation and taxes per year in USD 27,235,150

Relative Comparison Between the Two Proposals Using Net Present Value (NPV), Internal Rate of Return (IRR) and the Payback Period Methods

|                      | SAP S/4 HANA | RedPrairie |
|----------------------|--------------|------------|
| Investment required  | 1,720,190    | 1,648,720  |
| Expected life        | 5            | 5          |
| Depreciation per year| 344,038      | 329,744    |
| Income tax rate (in %)| 30           | 30         |
| Scrap value at the end of 5 years | Nil | Nil |

NPV and Payback Period Method

SAP S/4 HANA Proposal

**NPV method**

| Year | 1 | 2 | 3 | 4 | 5 |
|------|---|---|---|---|---|
| Profit before depreciation and taxes | 30606508 | 30606508 | 30606508 | 30606508 | 30606508 |
| Depreciation | 344038 | 344038 | 344038 | 344038 | 344038 |
| Earnings before taxes (EBT) | 30262470 | 30262470 | 30262470 | 30262470 | 30262470 |
| Income tax @30% | 9078741 | 9078741 | 9078741 | 9078741 | 9078741 |
| Profit after taxes | 21183729 | 21183729 | 21183729 | 21183729 | 21183729 |
| Add depreciation back | 344038 | 344038 | 344038 | 344038 | 344038 |
| Net cash flow | 21527767 | 21527767 | 21527767 | 21527767 | 21527767 |
| Present value factor @10% | 0.9091 | 0.8264 | 0.7513 | 0.6830 | 0.6209 |
| Present Value | 19570697 | 17791543 | 16174130 | 14703755 | 13367050 |

Total present value for future cash flows for SAP S/4 HANA proposal 81607174

Less initial investment 1720190

Net present value for SAP S/4 HANA proposal 79886984

**Payback period** 0.088 year

DA WMS—RedPrairie Proposal

**JDA WMS - RedPrairie proposal**

| Year | 1 | 2 | 3 | 4 | 5 |
|------|---|---|---|---|---|
| Profit before depreciation and taxes | 27235150 | 27235150 | 27235150 | 27235150 | 27235150 |
| Depreciation | 329744 | 329744 | 329744 | 329744 | 329744 |
| Earnings before taxes (EBT) | 26905406 | 26905406 | 26905406 | 26905406 | 26905406 |
| Income tax @30% | 8071622 | 8071622 | 8071622 | 8071622 | 8071622 |
| Profit after taxes | 18833784 | 18833784 | 18833784 | 18833784 | 18833784 |
| Add depreciation back | 329744 | 329744 | 329744 | 329744 | 329744 |
| Net cash flow | 19163528 | 19163528 | 19163528 | 19163528 | 19163528 |
| Present value factor @10% | 0.9091 | 0.8264 | 0.7513 | 0.6830 | 0.6209 |
| Present Value | 17421389 | 15837627 | 14397842 | 13088948 | 11899043 |

Total present value for future cash flows for RedPrairie proposal 72644849

Less initial investment 1648720

Net present value for RedPrairie proposal 70996129

**Payback period** 0.095 year
**IRR Method**

**SAP S/4 HANA**

As a basic rule, we calculate IRR by trial and error method. We will try to determine that discount rate which gives NPV = 0.

Let us start with a 50 per cent interest rate to discount the future cash flows.

| SAP S/4 HANA proposal | Year | 1 | 2 | 3 | 4 | 5 |
|------------------------|------|---|---|---|---|---|
| Profit before depreciation and taxes | 30606508 | 30606508 | 30606508 | 30606508 | 30606508 |
| Depreciation | 344038 | 344038 | 344038 | 344038 | 344038 |
| Earnings before taxes (EBT) | 30262470 | 30262470 | 30262470 | 30262470 | 30262470 |
| Income tax @30% | 9078741 | 9078741 | 9078741 | 9078741 | 9078741 |
| Profit after taxes | 21183729 | 21183729 | 21183729 | 21183729 | 21183729 |
| Add depreciation back | 344038 | 344038 | 344038 | 344038 | 344038 |
| Net cash flow | 21527767 | 21527767 | 21527767 | 21527767 | 21527767 |
| Present value factor @50% | 0.6667 | 0.4444 | 0.2963 | 0.1975 | 0.1317 |
| Present value | 14351845 | 9567896 | 6378598 | 4252398 | 2834932 |

Total present value for future cash flows: 37385669

Less initial investment: 1720190

Net present value for SAP S/4 HANA proposal: 35665479

An IRR of 50 per cent gives a significant high NPV. So, let us consider IRR = 100 per cent.

| SAP S/4 HANA proposal | Year | 1 | 2 | 3 | 4 | 5 |
|------------------------|------|---|---|---|---|---|
| Profit before depreciation and taxes | 30606508 | 30606508 | 30606508 | 30606508 | 30606508 |
| Depreciation | 344038 | 344038 | 344038 | 344038 | 344038 |
| Earnings before taxes (EBT) | 30262470 | 30262470 | 30262470 | 30262470 | 30262470 |
| Income tax @30% | 9078741 | 9078741 | 9078741 | 9078741 | 9078741 |
| Profit after taxes | 21183729 | 21183729 | 21183729 | 21183729 | 21183729 |
| Add depreciation back | 344038 | 344038 | 344038 | 344038 | 344038 |
| Net cash flow | 21527767 | 21527767 | 21527767 | 21527767 | 21527767 |
| Present value factor @100% | 0.5 | 0.25 | 0.125 | 0.0625 | 0.03125 |
| Present value | 10763884 | 5381942 | 2690971 | 1345485 | 672743 |

Total present value for future cash flows: 2085024

Less initial investment: 1720190

Net present value for SAP S/4 HANA proposal: 19134834

Even for an interest rate of 100 per cent, we can see that the NPV is greater than 0. The IRR is way ahead of the expectation of the company, so there is no question of rejecting this proposal.

**JDA WMS—RedPrairie**

Like the above calculations, let us start with a 50 per cent interest rate to discount the future cash flows in case of RedPrairie.

| JDA WMS—RedPrairie proposal | Year | 1 | 2 | 3 | 4 | 5 |
|------------------------------|------|---|---|---|---|---|
| Profit before depreciation and taxes | 27235150 | 27235150 | 27235150 | 27235150 | 27235150 |
| Depreciation | 329744 | 329744 | 329744 | 329744 | 329744 |
| Earnings before taxes (EBT) | 26905406 | 26905406 | 26905406 | 26905406 | 26905406 |
| Income tax @30% | 8071622 | 8071622 | 8071622 | 8071622 | 8071622 |
| Profit after taxes | 18833784 | 18833784 | 18833784 | 18833784 | 18833784 |
Add depreciation back 329744 329744 329744 329744 329744 329744
Net cash flow 19163528 19163528 19163528 19163528 19163528
Present value factor @50% 0.6667 0.4444 0.2963 0.1975 0.1317
Present value 12775685 8517124 5678082 3785388 2523592
Total present values for future cash flows 33279872
Less initial investment 1648720
Net present value for RedPrairie proposal 31631152

An IRR of 50 per cent gives a significant high NPV. So, let us consider IRR = 100 per cent.

| JDA WMS - RedPrairie proposal |
|-------------------------------|
| Year                         | 1   | 2   | 3   | 4   | 5   |
| Profit before depreciation and taxes | 27235150 | 27235150 | 27235150 | 27235150 | 27235150 |
| Depreciation                | 329744  | 329744  | 329744  | 329744  | 329744  |
| Earnings before taxes (EBT)  | 26905406 | 26905406 | 26905406 | 26905406 | 26905406 |
| Income tax @30%             | 8071622 | 8071622 | 8071622 | 8071622 | 8071622 |
| Profit after taxes          | 18833784 | 18833784 | 18833784 | 18833784 | 18833784 |
| Add depreciation back       | 329744  | 329744  | 329744  | 329744  | 329744  |
| Net cash flow               | 19163528 | 19163528 | 19163528 | 19163528 | 19163528 |
| Present value factor @100%  | 0.5  | 0.25  | 0.125  | 0.0625  | 0.03125 |
| Present value               | 9581764 | 4790882 | 2395441 | 1197721 | 598860.3 |
| Total present values for future cash flows | 18564668 |
| Less initial investment     | 1648720 |
| Net present value for RedPrairie proposal | 16915948 |

Even for an interest rate of 100 per cent, we can see that the NPV is greater than 0. The IRR is way ahead of the expectation of the company, so there is no question of rejecting this proposal.

**Conclusion**

As we compare both the proposals in the IRR method, we can say that there is not much difference between them, as both IRR is showing value more than 100. So, both can be accepted. But when we compare the two options in terms of NPV method and Payback Period, we see some difference. SAP S/4 HANA is better than RedPrairie by an NPV of 8,890,855 USD. Also, the payback period for SAP S/4 HANA which is 0.088 year (1.06 months) is better than the RedPrairie proposal which is 0.095 year (1.14 months), although the difference is not very significant.

**Technology Section**

**Comparison in Terms of Analytical Abilities**

In the analytics section, SAP S/4 HANA has a clear edge over its competitor, RedPrairie because of the various factors mentioned below.

1. EWM provides inbuilt warehouse analytic tool known as the **warehouse cockpit**, which displays the warehouse key figures and defined EGF objects (easy graphic framework) can be used to evaluate and monitor the same using various charts. If the graphs available in the standard are not sufficient, then the tool can be easily enhanced as per requirements. The warehouse cockpit consists of material services, material flow system like the status of the communication channel, communication layer and overdue objects such as warehouse tasks, warehouse orders, waves, warehouse tasks time series and warehouse orders time series. Similar cockpit is unavailable in RedPrairie. It will attract huge customization cost to offer similar services in RedPrairie.

2. EWM also provides functions wherein you can define your warehouse key figures supported by the system known as the **measurement services**. These services can be customized using the tailored and calculated measurement services (TMS and CMS), for example, outbound deliveries which left the warehouse too late or the number of open physical inventory document older than 1 week. These key figures can be configured by the warehouse manager to plan his warehouse efficiently. SAP has integrated these services with the warehouse management monitor for creating a TMS, operational planning in
labour management for calculating engineered labour standards and warehouse cockpit for monitoring the results graphically. These kinds of services are unavailable in RedPrairie package.

3. Proof of delivery (PoD) in SAP ERP is a data which can be entered in the system by the warehouse operator. It is the deviation of physical quantity reported by the ship-to parties and the quantity on the delivery slip. EWM provides an in-built feature in the EWM monitor which provides a detailed PoD analysis which helps in finding out the root cause of incorrect deliveries in outbound processes. The PoD data can be used by the measurement services to build KPIs such as ratio outbound delivery errors, and warehouse operators can monitor the data in warehouse cockpit. The similar monitor is not available in RedPrairie package.

4. Warehouse management monitor is a state-of-the-art central tool to update the warehouse supervisors on the current situation in the warehouse. This tool consists of alert monitoring capabilities, which highlights the warehouse supervisors regarding the actual and problematic situations in the warehouse and provides exception handling tools. The monitor contains various nodes such as documents, processes and alerts. SAP has integrated the warehouse management monitor with SAP BI, which empowers it to use SAP crystal reports using various graphical views. A similar tool is unavailable in RedPrairie.

5. There are various other analytic tools available in EWM build on SAP S/4 HANA which gives EWM an edge over RedPrairie analytics.
   a) Supply chain manager—Enables cross-warehouse performance monitoring.
   b) Warehouse supervisor—Enables comprehensive central warehouse operation monitoring, alert and exception monitoring, drill-down and direct-action triggering.
   c) Cross distribution centre performance dashboard—Enables KPI monitoring, service level analysis, warehouse capacity usage overview.

6. Labour management dashboard in EWM provides a series of functions to manage the labour hours in a warehouse more effectively, thereby making the warehouse more productive. Warehouse supervisors can measure, plan, simulate and visualize the activities in the warehouse. The performance of the warehouse employees can be measured based on the engineered labour standards. After the execution of planned work, the planned and actual times can be compared to trigger incentives such as bonus payments using a connected HR management system. Warehouse supervisors can use the system for accurate workload forecasting and efficient capacity balancing. The dashboard also provides real-time labour activity visibility for improved efficiency and timely response to problems. A similar tool is available in JDA. JDA comprises a state-of-the-art labour and workforce management tool in their software which transforms a warehouse into self-accountable and performance oriented. JDA has accomplished this transformation through a proven, step-by-step method.

7. S/4 HANA comes with SAP Leonardo, which includes a portfolio of offerings ranging from IoT, blockchain, machine learning (ML), big data, data intelligence and design thinking and analytics. SAP S/4 HANA also provides a set of enhancements combining new ML and artificial intelligence (AI) capabilities with existing business intelligence and planning workflows. Innovative solutions to enhance operations are adopted and implemented by customers. These innovative solutions range from robotic process automation, ML and enhanced analytics leading to an intelligent ERP known as the iERP. SAP Leonardo ML platform provides customers with predictive and cognitive analytics, application function library (AFL) which is the TensorFlow serving and also a HANA-R integrator which enables HANA studio to connect to R server, which is a state-of-the-art analytic tool. JDA RedPrairie is way behind SAP in embracing new technological innovations, and they have not yet introduced ML or AI in their warehouse solutions.

**Conclusion**

Except for labour management, RedPrairie does not have any state-of-the-art analytical dashboard. Though RedPrairie offers the normal warehouse functions such as inbound and outbound logistics, inventory management, order processing, asset management and RFID enablement, still it lags EWM built on S/4 HANA in analytics. RedPrairie solution is for the small number of decentralized warehouses wherein different warehouses work in silos. For many bigger warehouses where centralization is the core business need, SAP’s EWM is way ahead of JDA’s RedPrairie.

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