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### **List of Abbreviations**

SDLC	Software Development Life Cycle
SEPS	Software Engineering Process Simulation
RUP	Rapid Unified Process
RAP	Rapid Application Development
SPSS	Statistical Package for Social Studies
CMSEEM	Content Management System Effort Estimation model
CMS	content management system
SPM	Software project management
XP	Extreme Programming
UML	Unified Modelling Language
SDM	Software development model

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# *Dedication*

To my parent who made me see the light...

To my lovely brothers & Sisters...

To my family and friends who supported me with their sincere  
feelings...

To my teachers throughout my career...



**Abstract:**

Software engineering provide set of methods, methodologies and practices that's used for the process of building and developing the information systems. Sudanese software companies follow many of these methodologies to develop and deliver software projects, but they face many challenges represented in the delay of delivering projects on time and the lack of method that predict the optimal number of team members accurately.

This research aims to develop simulation model to assist the project's managers in assigning the optimal team number for each development phase in order to improve the resource utilization and reduce the delay of delivery time. A simulation model has been implemented using Symphony.Net simulator and then evaluated using input data from fifteen Sudanese software companies.

The results of the first experiment showed the assigned team size was not enough to deliver all arrived projects on time, and by increasing the team size in the critical phases that required more time, the resources utilization improved and projects were delivered on time. The research recommends other software development methodologies to be simulated in order to select the best among them that could be applied in the Sudanese companies. Other factors that affect the delivery of projects such as complexity of requirements, developers' experience and customers' involvement in the development process should also be considered. It is also recommended to develop an integrated model that could be used to simulate project of different sizes in a single model.

## مستخلص البحث :

تقدم هندسة البرمجيات مجموعة من الطرق والمنهجيات التي تستخدم في بناء وتطوير نظم المعلومات، تتبع شركات البرمجة في السودان عدد من هذه المنهجيات لتطوير وتسليم المشاريع البرمجية، الا أن هذه الشركات تواجه عدد من التحديات تتمثل في تأخير وقت التسليم بالإضافة الى قصور الطريق المستخدمة للتنبؤ بتخصيص العدد الأمثل لفريق التطوير. يهدف البحث الي تطوير نموذج محاكاة لمساعدة مدراء المشاريع في تخصيص العدد الامثل من فريق التطوير في كل مرحلة من مراحل التطوير وذلك لتحسين استخدامية الموارد وتقليل التأخير في عملية التسليم.

تم بناء النموذج باستخدام اداة المحاكاة Simphony.Net والتحقق منه باستخدام بيانات تم جمعها من 15 شركة تعمل في تطوير البرمجيات بالسودان. أظهرت النتائج الأولية أن حجم الفريق الذي يتم تخصيصه غير كافي لتسليم كل المشاريع الوارده في الوقت المحدد، وبزيادة حجم فريق التطوير للمراحل التي تتطلب وقت أطول أدى ذلك لزيادة الاستخدامية وتسليم كافة المشاريع في الوقت المحدد.

أوصت الدراسة بمحاكاة مختلف منهجيات التطوير لإختيار الأفضل من بينها وتطبيقه على شركات تطوير البرمجيات مع الوضع في الاعتبار باقي العوامل التي تؤثر في عملية التسليم مثل تعقيد متطلبات المشاريع ومستوي خبرة فريق التطوير وإشراك العملاء في عملية التطوير. كما أوصت ببناء نموذج متكامل يمكن أن يعمل على محاكاة مختلف أحجام المشاريع في نموذج واحد.